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D. M. BEACH, *Editor*

Volume 22, No. 4 June 1941

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PLANNING THE INTERREGIONAL HIGHWAY SYSTEM[1]

BY THE DIVISION OF HIGHWAY TRANSPORT, PUBLIC ROADS ADMINISTRATION

Reported by **H. E. HILTS**, Assistant Chief, Division of Highway Transport

THE concept of an interregional highway system is no startling innovation to the highway builders of this country. Since the first settlers landed on American shores, people have been dreaming of it and building it.

The construction of routes that form the basic outline of the interregional system (fig. 1) has been quickened by the advent of gas-driven vehicles whose owners have been farsighted enough to join in reasonable cooperation in financing by public investment the highway plant that is now one of the world's wonders. To those who have lived in this era the highway plant has seemed to grow at an uncommonly leisurely pace largely because Americans are, in the main, a restless, creative people.

Interregional highways have been built in this country from its earliest days. Their character and extent have always been limited by available funds, which, in turn, have depended upon the economic importance of the mode of transport that has used them.

The present need of a balanced interregional system of free highways to serve the respective needs of the regions traversed as well as the needs for longer interregional movements is apparent. This system should mainly be made up of the most direct routes between the major centers of population and the belts of heaviest population.

A tentatively defined interregional system is located and the needs of the system are discussed. Design standards are given and cost estimates on both a long-term program and an emergency program are quoted. The distribution of the system in geographic regions is analyzed and preliminary indications of the use, cost of operating, and the earning capacity of the system are developed.

Now the main highway network is practically all surfaced and, in order to attain major benefits promptly for both civil and military requirements, it seems logical to plan and carry out a program of betterments and new construction on routes carrying large volumes of swiftly moving traffic between the country's main population centers. This was probably the impelling reason when the Congress included in the Federal Highway Act of 1938 a provision, section 13, which directed the Chief of the Bureau of Public Roads to investigate and to report to the Congress on the feasibility of building and operating as toll roads six express highways.

The results of the investigation undertaken pursuant to this instruction were published in Toll Roads and Free Roads, House Document No. 272, 76th Congress, First Session. From the discussion in that report there emerged a general outline of what was called A Master Plan for Free Highway Development. The consummation of this plan calls for the full cooperation of the Federal and State Governments. The program outlined in that report includes the following five points:

1. The construction of a special, tentatively defined system of direct interregional highways, with all necessary connections through and around cities, designed to meet the requirements of the national defense in time of war and the needs of a growing peacetime traffic of longer range.
2. The modernization of the Federal-aid highway system.
3. The elimination of hazards at railroad grade crossings.
4. An improvement of secondary and feeder roads, properly integrated with land-use programs.
5. The creation of a Federal Land Authority empowered to acquire, hold, sell, and lease lands needed for public purposes and to acquire and sell excess lands for the purpose of recoupment.

This paper deals with the general problems encountered in a tentative study of the first point together with some remarks on an emergency modernization of the tentatively defined interregional system and the elimination of hazards at grade crossings on the system.

29,330 MILES INCLUDED IN INTERREGIONAL SYSTEM

The system shown in figure 1 and tentatively selected after close cooperation with State and Federal agencies includes substantially all of the major interregional lines of travel. The system is 29,330 miles in length, of which 25,554 miles are rural in character and 3,776 miles are in urban territory. Figure 2 shows that it serves substantially all of the major population centers and the belts of heaviest population.

Traffic maps of the routes to be improved, given in figures 3 and 4, show the routes as the most heavily traveled, on the whole, of all the routes in the U. S. numbered system of highways. Improved as a system of largely limited-access free roads, it will attract traffic and generate new activities. To show how the traffic builds up in cities, the traffic flow has been plotted vertically in profile form and is shown in figure 5.

The existing rural routes most nearly conforming to the direct routes of the interregional system (figs. 6 and 7) now serve almost 11 percent of the total vehicle-miles of travel on all rural highways. Although their length represents only about 1 percent of the total rural highway mileage of the country, it is estimated that the completed system would unquestionably accommodate at least 12.5 percent of the total rural vehicle mileage. By providing ample capacity and up-to-date safety devices these free roads would effect a material reduction in the highway accident rate.

In the data submitted in this paper the direct routes follow the alinement and incorporate the improvements of existing highways with deviations from direct routes between population concentrations in limited degree only to accommodate the largest intermediate towns.

The routes are assumed to join facilities that will promote free movement of traffic to and through the centers of the cities. At large cities, wherever necessary, limited-access belt lines will have to be provided. All small communities are assumed to be bypassed. The two conditions cited are premised upon whether the city or town contributes either (1) the larger, or

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[1] Paper presented at the Twentieth Annual Meeting of the Highway Research Board, December 1940.

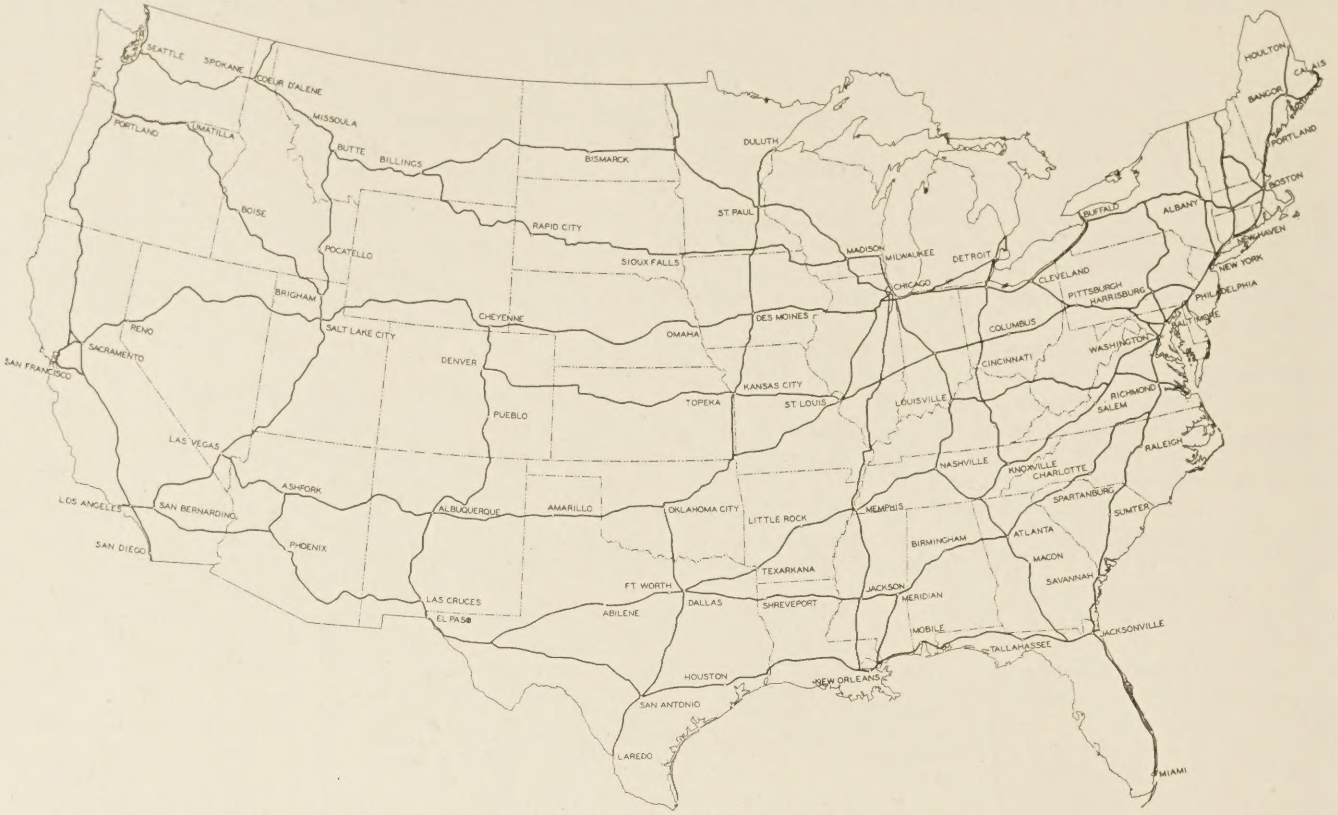

Figure 1.—Existing Highways Following the Approximate Alinement of the Tentatively Selected Interregional Highway System.

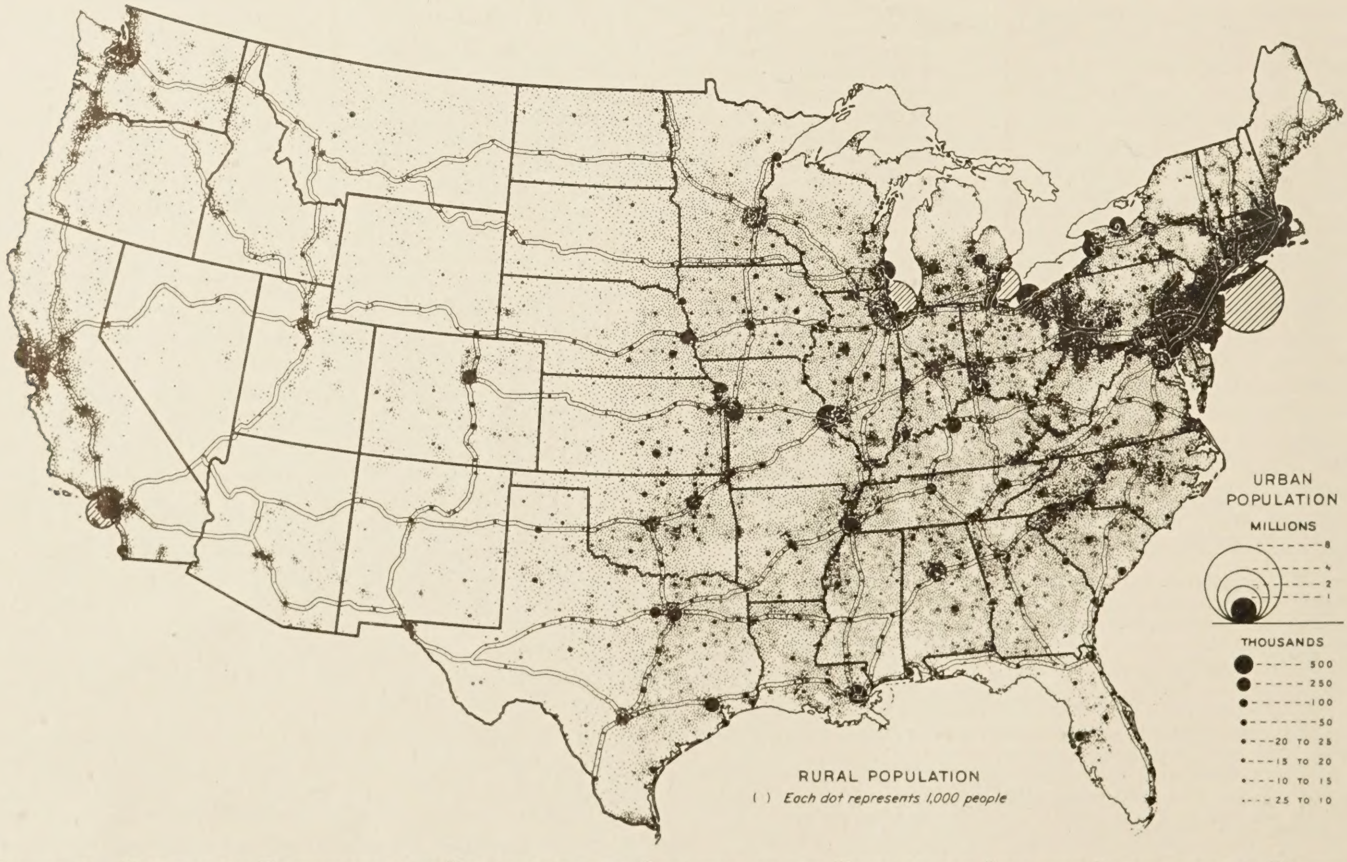

Figure 2.—Population Distribution in Relation to the Location of the Tentatively Selected Interregional Highway System.

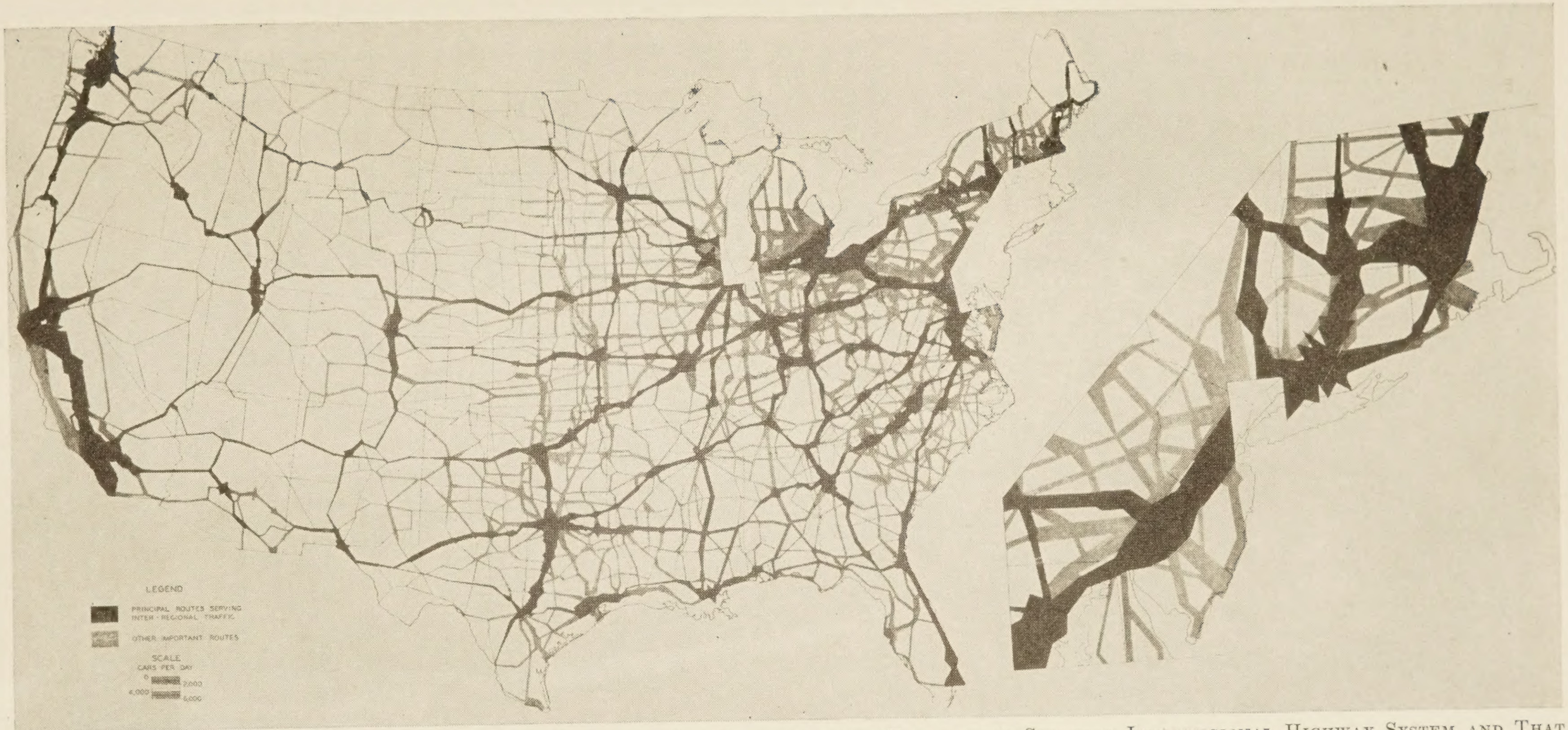

FIGURE 3.—COMPARISON BETWEEN THE AVERAGE DAILY PASSENGER-CAR TRAFFIC ON THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM AND THAT ON OTHER IMPORTANT ROUTES, 1937 DATA.

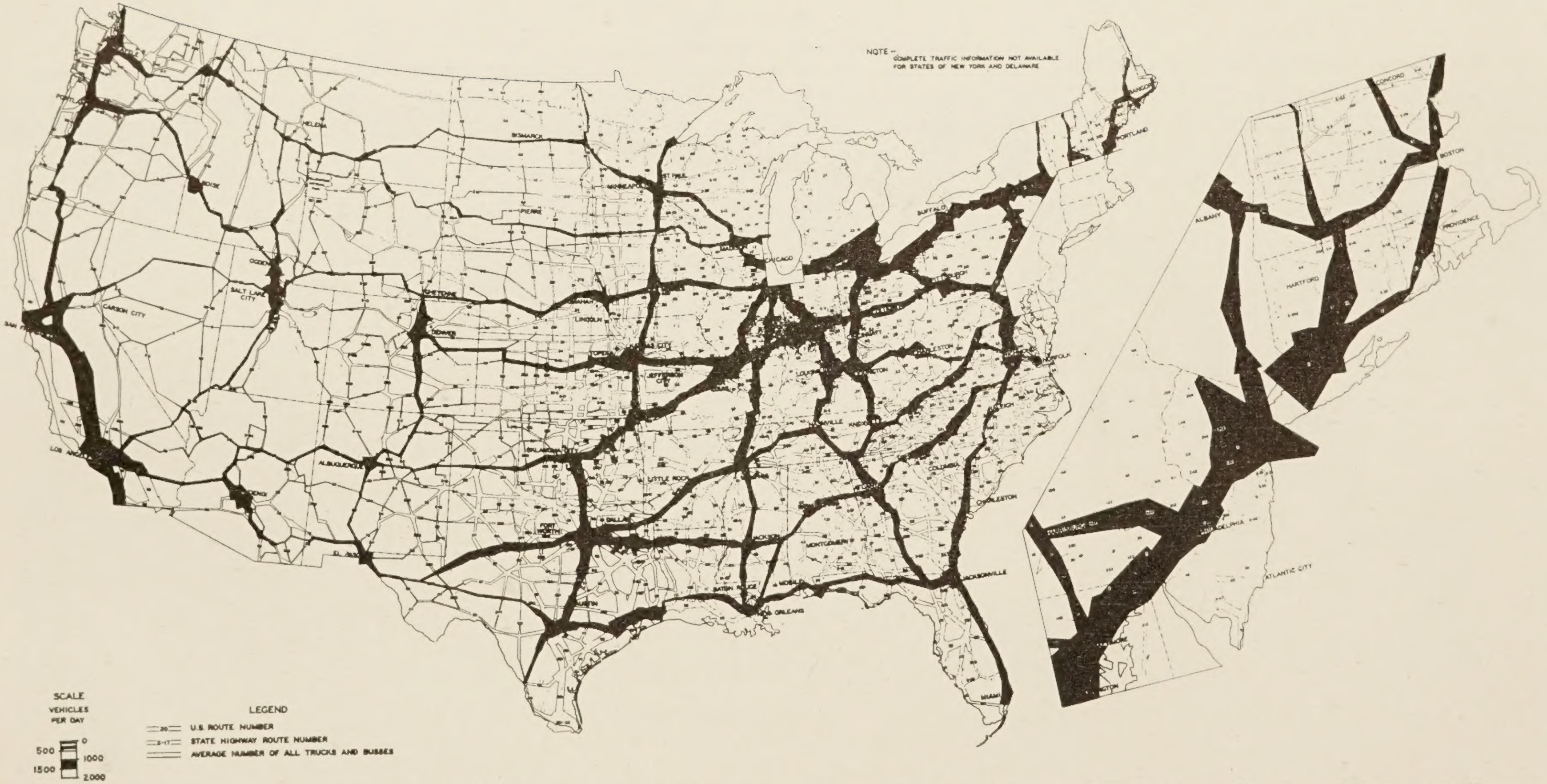

FIGURE 4.—COMPARISON BETWEEN THE AVERAGE DAILY TRUCK AND BUS TRAFFIC ON THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM AND THAT ON OTHER IMPORTANT ROUTES, 1938 DATA.

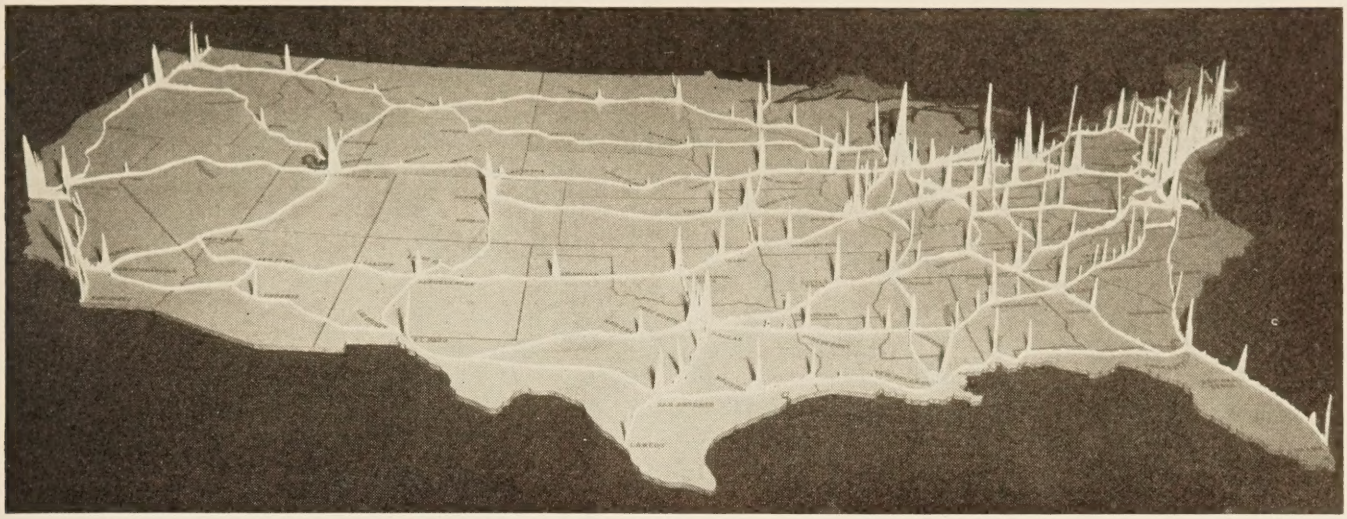

FIGURE 5.—TRAFFIC FLOW PROFILE OF THE TENTATIVE INTERREGIONAL HIGHWAY SYSTEM, 1937 DATA.

(2), the smaller part of the expected traffic on the route at its boundaries.

In general, the main rural highways of the Nation, beyond the immediate vicinity of the cities, are of sufficient capacity to discharge the flow of present traffic.

If a slight restriction of absolute freedom of movement is accepted, which is to be expected on the rural highways during short periods of maximum hourly traffic volume that occur in the course of a year, an average daily volume of 3,000 vehicles may be considered as within the reasonably convenient discharge capacity of a 2-lane highway.

On this basis, figure 8 shows the portions of the interregional system now having only two lanes which should be widened. Sections now having four or more lanes are also shown in figure 8. To emphasize the contrast, figure 9 has been prepared to show only the existing sections having four or more lanes. These data were obtained by analysis of diagrams that will be discussed later. They have been prepared for the entire tentative interregional system, first, between route intersections, and second, as continuous routes between main city termini. These diagrams show the main physical and operating characteristics of the entire system. An analysis of these diagrams (table 1) shows that on the tentative system, 1,230 miles of more than 2-lane width are within 25 miles of municipalities having populations exceeding 100,000, of which 500 miles are 3-lane width and 730 miles are 4-lane width. The traffic data (table 2) show that to provide adequate traffic facilities, 1,770 additional miles of more than 2-lane width should be constructed within 25 miles of the larger municipalities, and 1,230 additional miles should be constructed on the remaining part of the rural interregional system.

The traffic standards suggested above contemplate the construction of roads greater than two lanes in width when the present average daily traffic volume exceeds 3,000 vehicles. For the purpose of this discussion it is assumed that 4-lane divided highways will be built at locations having present average traffic volumes of from 3,000 to 10,000 vehicles per day. Should the present average volume exceed 10,000 vehicles per day, it might be that special conditions would require still wider pavements, but such requirements should be determined by analysis of each case rather than by resort to a general standard.

TABLE 1.—*Present lengths of sections of the tentative interregional highway system having more than 2 lanes, located within 25 miles of cities of more than 100,000 population*

Geographic division	Lengths having 3 lanes	Lengths having 4 lanes or more	Total
	Miles	*Miles*	*Miles*
New England	80	90	170
Middle Atlantic	140	130	270
East North Central	80	150	230
West North Central	30	70	100
South Atlantic	70	90	160
East South Central	10	30	40
West South Central	10	60	70
Mountain	----------	10	10
Pacific	80	100	180
United States	500	730	1,230

TABLE 2.—*A comparison between the length of sections of the tentative interregional highway system requiring widths in excess of 2 lanes and the length of the existing sections having more than 2 lanes* [1]

Geographic division	Length of sections requiring more than 2 lanes		Length of sections both requiring and now having more than 2 lanes [2]		Length of sections requiring widening	
	Located within 25 miles of cities	Located beyond 25 miles of cities	Located within 25 miles of cities	Located beyond 25 miles of cities	Located within 25 miles of cities	Located beyond 25 miles of cities
New England	390	180	170	70	220	110
Middle Atlantic	560	450	260	160	300	290
East North Central	540	280	200	100	340	180
West North Central	210	80	40	80	170	--------
South Atlantic	430	240	150	160	280	80
East South Central	100	30	10	--------	90	30
West South Central	220	190	40	30	180	160
Mountain	90	60	10	40	80	20
Pacific	270	610	160	250	110	360
United States	2,810	2,120	1,040	890	1,770	1,230

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[1] The determination of need is based on the assumption that routes carrying in excess of 3,000 vehicles per day should be wider than 2 lanes.

[2] Length of sections now having more than 2 lanes and carrying more than 3,000 vehicles per day.

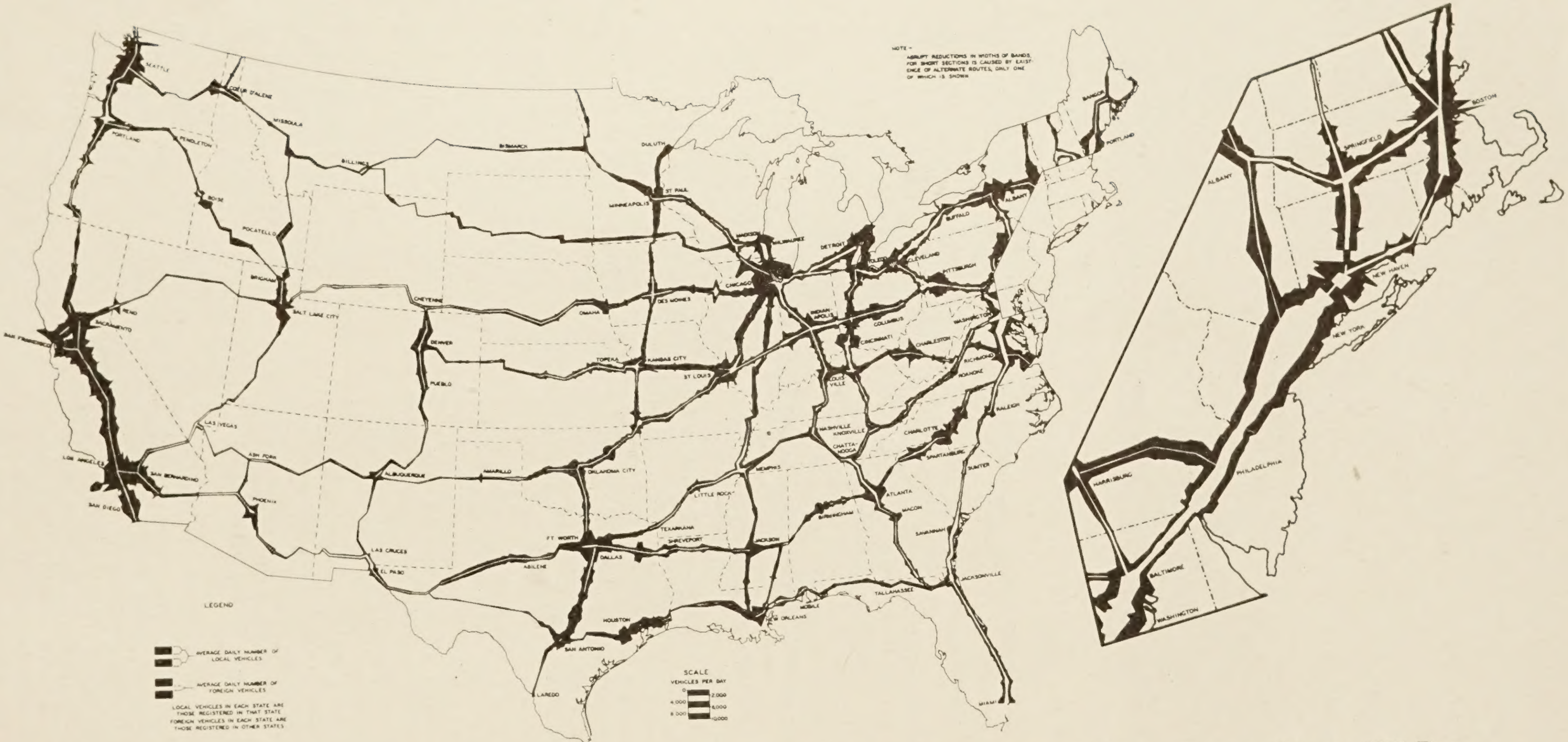

FIGURE 6.—THE AVERAGE DAILY PASSENGER-CAR TRAFFIC ON THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM, 1937 DATA.

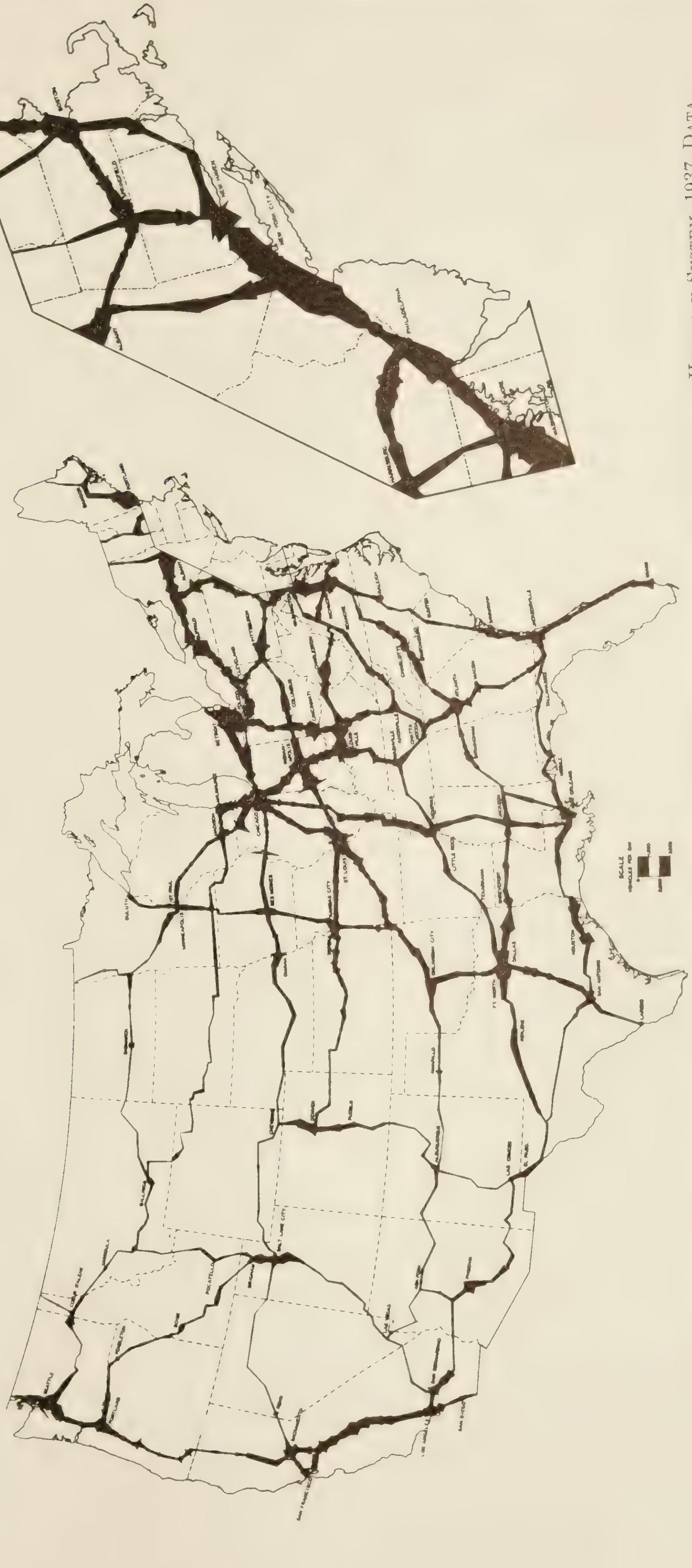

FIGURE 7.—THE AVERAGE DAILY TRUCK AND BUS TRAFFIC ON THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM, 1937 DATA.

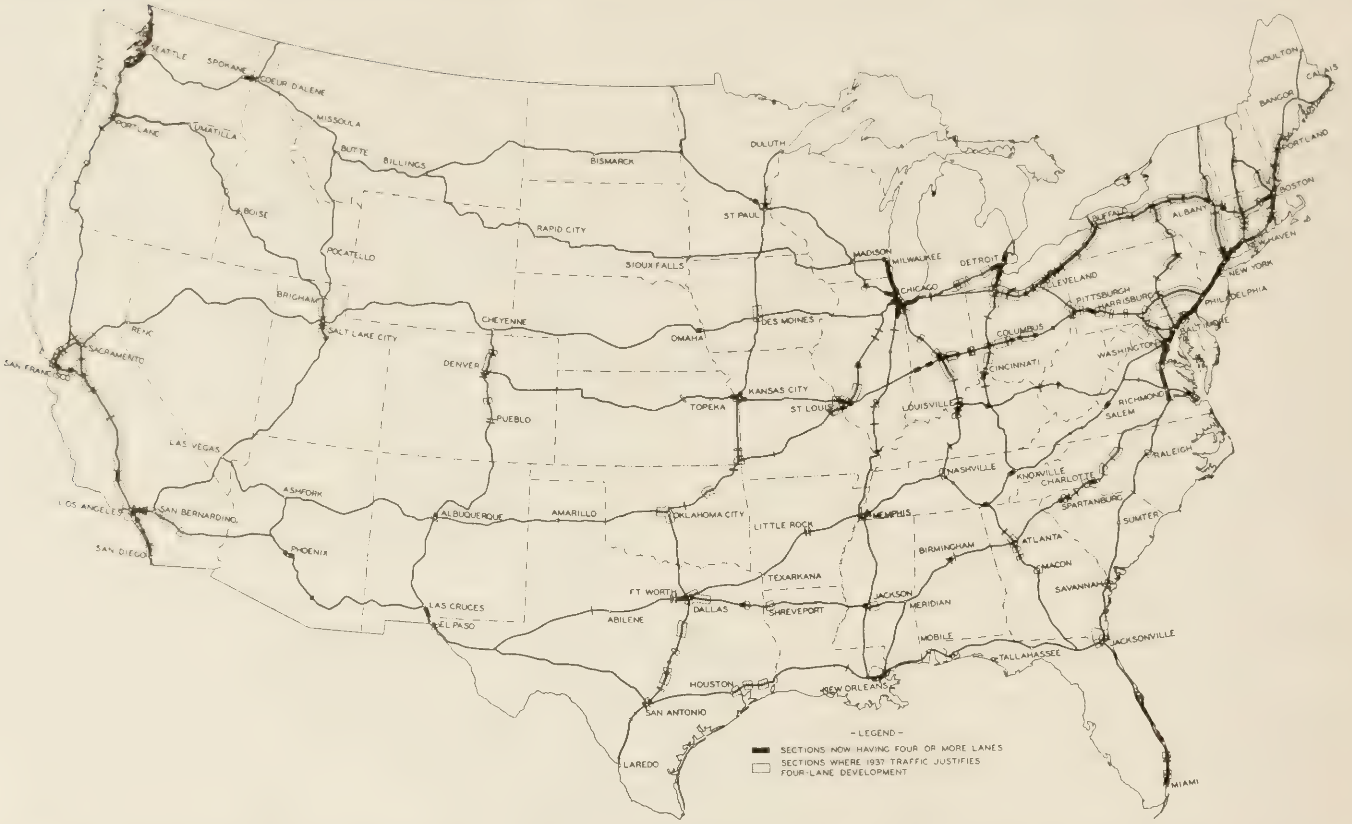

Figure 8.—Location of Sections of the Tentatively Selected Interregional Highway System Having Four or More Lanes, and Other Sections Where 1937 Traffic Data Indicate the Need of Improvement to Four-Lane Standards.

PEAK TRAFFIC GREATLY EXCEEDS AVERAGE TRAFFIC VOLUME

By correlating the analysis of the complete records of 89 fixed-type automatic traffic counters, selected from a total of some 500 now in operation, with the analysis of speed and passing distance studies made on 28 sections of 2-lane highway in Virginia, Maryland, Massachusetts, New York, Connecticut, and Illinois, and on 8 sections of 4-lane undivided highway and 5 sections of 4-lane divided highway in Massachusetts, New York, and Illinois, the following present general résumé appears reasonable. During certain periods of the year, and particularly on weekends, the daily traffic will far exceed the average. On roads with an average daily volume of 3,000 vehicles it may be expected that on 1 day each year the volume will reach 7,300 vehicles, and that on the 10 days of heaviest traffic the daily volume will exceed 5,700 vehicles. This latter figure corresponds to what might be expected on a normal summer Sunday.

On the average road carrying an average daily volume of 10,000 vehicles, the maximum daily volume will probably reach 18,500 vehicles, and on the tenth highest day, or the summer Sunday condition, the daily volume may be expected to be 15,000 vehicles. That volumes in this range require special analysis is shown by the fact that on one road, a modern 4-lane divided highway corresponding to the design proposed for the interregional system, an average traffic of 10,000 vehicles per day resulted in a peak day's flow of 24,000 vehicles, and on the 10 days of highest traffic volume, the daily flow exceeded 19,000 vehicles. Either special conditions induced these larger peaks, or the road's design permitted a traffic movement more nearly corresponding to the desires of the traveling public. The latter explanation is quite reasonable when it is considered that the peaks on this road are in the same proportion to the average daily flow of 10,000 as they are on the other roads with but 3,000 vehicles per day. Undoubtedly, congestion caused by poor alinement, intersections, and other restrictive features deters some travel and tends to lengthen the peak periods and thus to lower the peaks.

The significance of these figures is emphasized by translating them to terms of hourly traffic density and measures of congestion. On the average highway carrying an average daily volume of 3,000 vehicles, it may be expected that during 1 hour of the year the volume will be 750 vehicles, and during the 10 hours of heaviest flow the volume will exceed 550 vehicles per hour. As a result of studies on selected average 4-lane roads it is estimated that with an average traffic of 10,000 vehicles per day, the maximum volume in any 1 hour during the year will be 1,750 vehicles, and for 10 hours the flow will exceed 1,450 vehicles per hour.

On the more modern road with its sharper traffic peaks, the hourly volume will reach 2,500 vehicles, and for 10 hours the flow will exceed 1,800 per hour. Since the 4-lane roads will be divided, however, the traffic in each direction will be of greater importance than the total. For an entire day the traffic in one direction will nearly equal that in the other. For individual hours, however, as much as 70 percent of the total may be in one direction. Average roads, with average traffic of 10,000 vehicles per day, thus will carry some 1,200 vehicles in one direction during the heaviest hour, while the road permitting free travel will be required to accommodate 1,750 vehicles in one direction during 1 hour of the year. With these traffic standards, vehicles will be able to move with very little

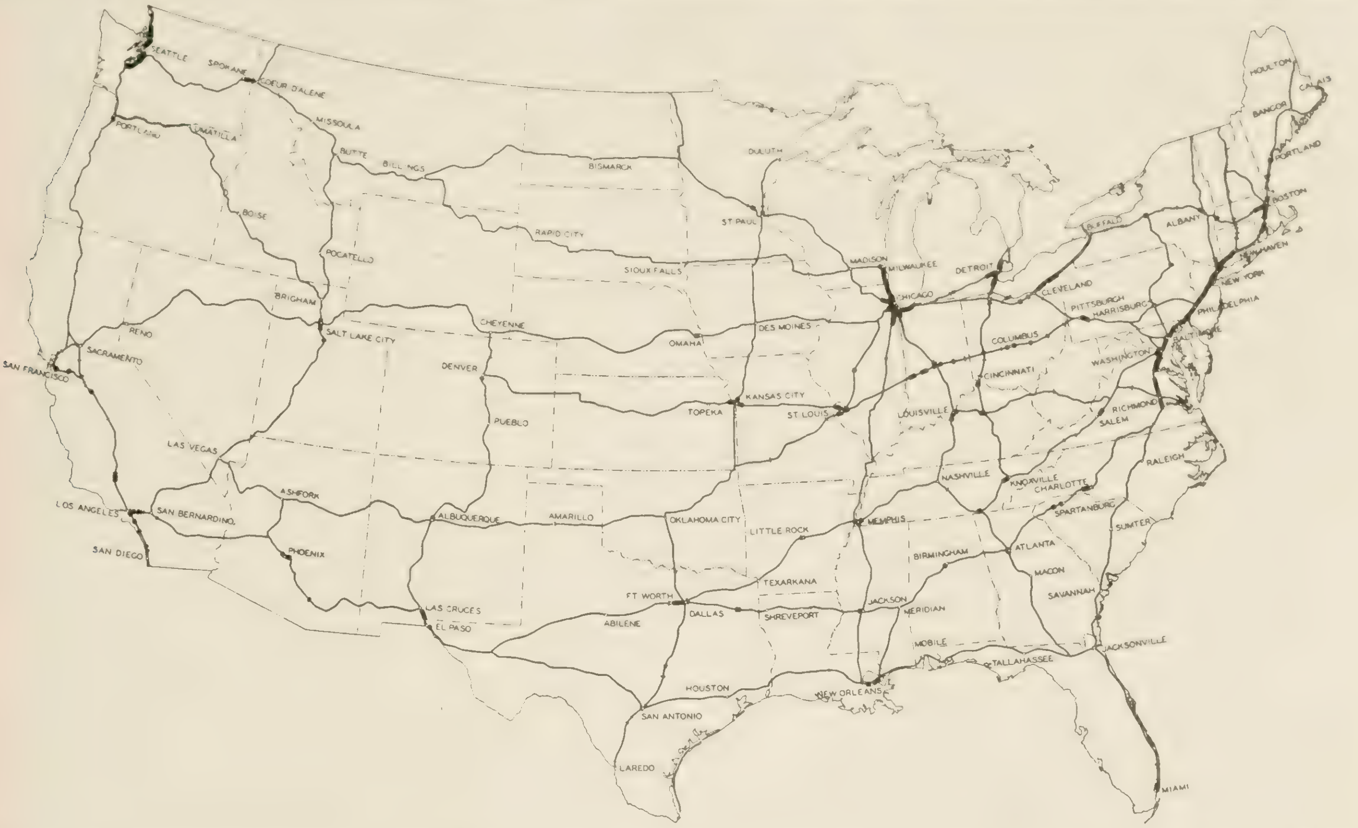

Figure 9.—Location of Sections of the Tentatively Selected Interregional Highway System Having Four or More Lanes.

restriction to speed even during the hour of heaviest flow.

Studies have been made on 12 sections of 2-lane road tangents with only minor restrictions in alinement and grade beyond the limits of the sections under study in Massachusetts, New York, and Illinois. According to records obtained on the best of these sections, vehicle speeds in the periods of lightest traffic will generally average between 42 and 45 miles per hour, with 10 percent of the vehicles traveling at 52 to 54 miles per hour or faster. With an hourly rate of 750 vehicles, the worst condition that may be expected on 2-lane roads, the average speeds will range from 39 to 42 miles per hour, with 10 percent of the vehicles moving at 48 to 50 miles per hour or faster. The average difference in speed between successive vehicles (designated herein as the congestion index), which is a measure of the freedom of movement, decreases from around 8 miles per hour in the lightest traffic to 5 or less at a rate of 750 vehicles per hour. Shifting from a 2-lane to a 4-lane divided road at this volume of 750 vehicles per hour, corresponding to 3,000 vehicles per day, the average speed increases to 47 miles per hour or faster, with 10 percent of the vehicles moving at 58 miles per hour or faster; and the congestion index shows a speed difference between vehicles of about 8 miles per hour.

Studies made on the best of four sections of road in two States indicate that as the average volume increases to 10,000 vehicles per day on an undivided 4-lane road on which the traffic is not retarded by intersections and roadside establishments, the maximum anticipated hourly volume of 1,200 vehicles in one direction would move at an average speed of 40 miles per hour, with 10 percent exceeding 54 miles per hour and the congestion index would become about 7 miles per hour. On modern 4-lane divided highways on which the sharper peaks will be expected, the maximum hourly rate in one direction may reach 1,750 vehicles per hour, but it is likely that the speeds will equal or exceed the values listed above for 1,200 vehicles per hour.

CHARTS SHOW PHYSICAL CONDITION OF SYSTEM

Figure 10 shows a portion of the interregional system from near Los Angeles to Sacramento, California, Distance on the diagram is represented by a very small scale. Beginning at the top, 1937 traffic density for the route is shown in terms of annual average 24-hour volume classified as total traffic, total trucks and busses, and that portion of the total that is classified as foreign (carrying out-of-State registration tags). Below traffic are shown the number of fatal accidents per mile and their location to the nearest mile. Below fatal accidents the number of restricted sight distances are given per individual mile classified as permanent or temporary. The number of sight distances shown are those in each individual mile that are shorter than desirable limits of 1,000 feet and 650 feet in non-mountainous and mountainous areas, respectively. Below sight distance data are shown the number of grades longer than 500 feet in each individual mile exceeding 5 percent in non-mountainous areas and 8 percent in mountainous areas, considered generally as desirable maximum limits.

Below grade data are represented to the indicated scale the number of curves in each individual mile of the highway that in 1937 were sharper than certain indicated desirable standards, generally 6 degrees in non-mountainous areas and 14 degrees in mountainous areas.

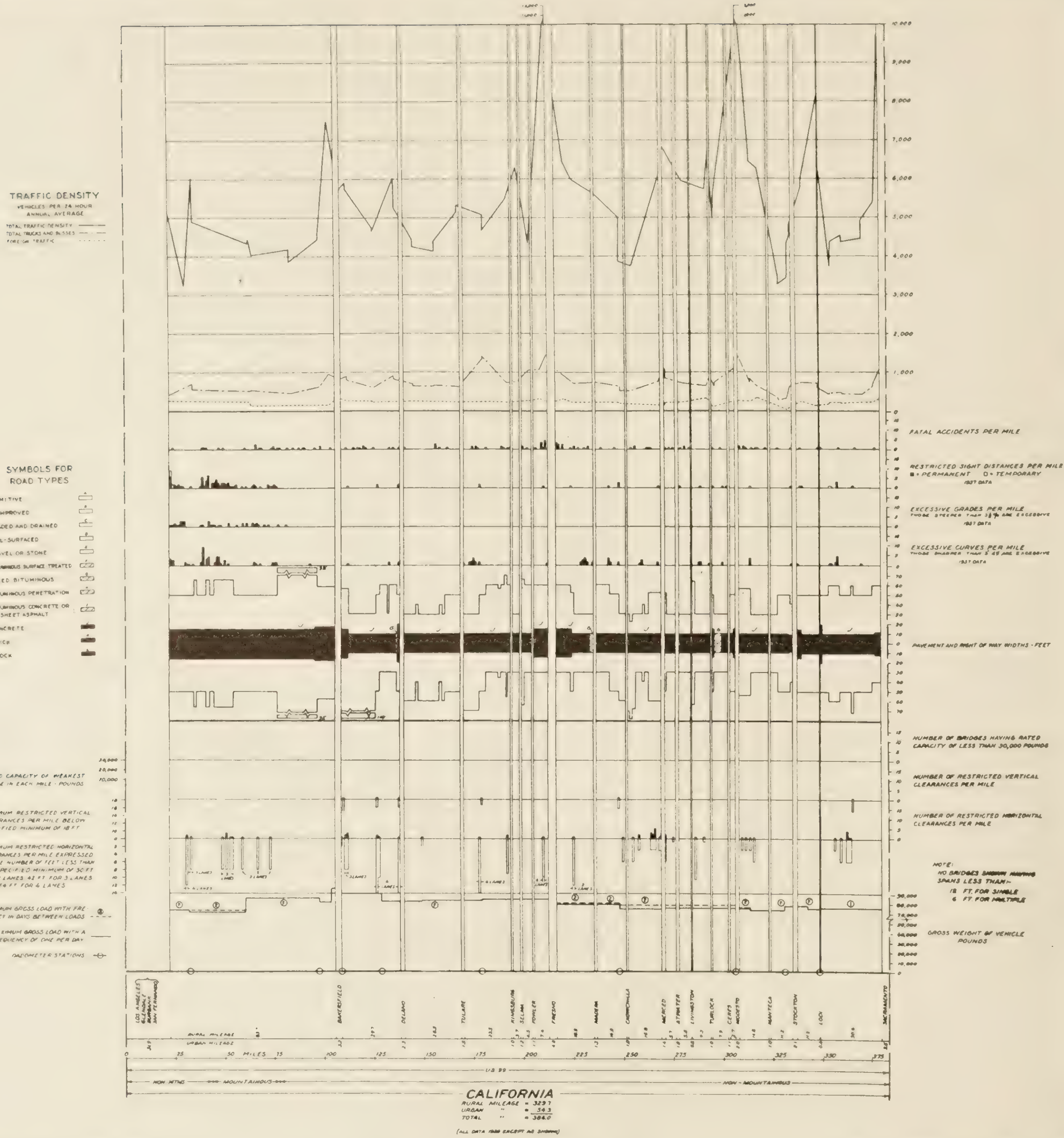

Figure 10.—Traffic Profiles, Limiting Physical Components of the Road, and Limiting Features of Bridges for a Section of the Tentatively Selected Interregional Highway System.

Below the curve data are shown pavement and right-of-way widths in feet. The character of the highway surface is represented by the shading or hatching within the broad bands extending across the diagram. The width of the pavement or surface on each mile is represented to the indicated scale by the width of the hatched band. The right-of-way width is shown to the same scale.

Below pavement and right-of-way width follow data on the number per mile of bridges having rated capacities of less than 30,000 pounds, and the rated capacity of the weakest bridge in each mile; the number per mile of restricted vertical clearances less than 18 feet, and the minimum vertical clearance in the mile; the number of restricted horizontal clearances per mile, and the minimum horizontal clearances per mile expressed as the number of feet less than the specified base width of 30 feet for 2 lanes, 42 feet for 3 lanes, and 54 feet for 4 lanes. The lowest data on the diagram show the maximum gross loads in pounds for the sections involved, based on the data for the loadometer stations located as shown by the circles on the lowest line. The maximum gross loads are shown for 1-day frequency by a solid line and for frequency in the number of days as

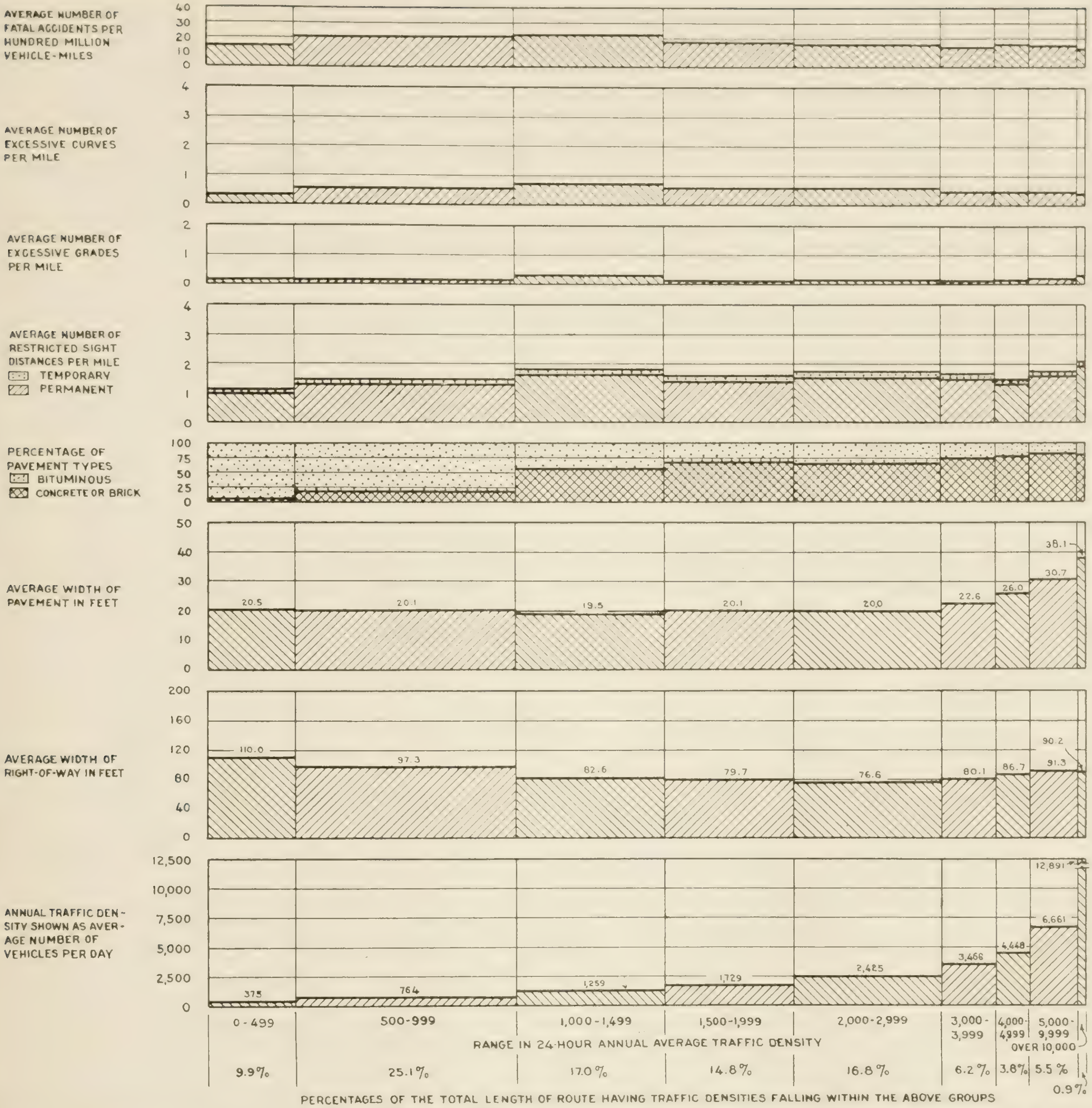

FIGURE 11.—SUMMARY OF PHYSICAL CONDITIONS ON RURAL SECTIONS OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM ARRANGED IN TRAFFIC VOLUME GROUPS.

indicated by the number within the circle by a broken line.

Below the diagram are shown the rural mileage, the urban mileage, a mileage scale, the U. S. route number, and the classification of the route into mountainous and non-mountainous.

Figure 11 is a summary of all the physical conditions on the existing mileage of rural sections of the tentative interregional system arranged in traffic-volume groups. This chart shows that 9.9 percent of the total rural mileage carries less than 500 vehicles per day, 25.1 percent carries between 500 to 999 vehicles per day, etc. The horizontal width of the space for showing features within each of the various density groups is proportional to these percentages.

In the lowest space of the chart the average number of vehicles per day for all sections falling within each traffic-density group is plotted. Next above this is plotted the average width of right-of-way for all sections falling within each group. Other conditions are shown graphically in the same manner in the other spaces.

On those sections carrying less than 500 vehicles per day are found the widest right-of-way, a relatively wide pavement, the lowest percentage of concrete or brick pavement, the fewest restricted sight distances per mile, relatively few excessive grades per mile, the fewest excessive curves per mile, and a relatively low rate of occurrence of fatal accidents. In sharp contrast are those sections carrying from 1,000 to 1,499 vehicles per day where there are found a relatively narrow right-of-way, the narrowest pavement, slightly more than 50 percent of the concrete or brick pavement, a relatively large number of restricted sight distances, the greatest number of excessive grades per mile, the greatest number of excessive curves per mile, and the most frequent rate of occurrence of fatal accidents.

Many significant relationships are shown in figure 11. The narrowest right-of-way is found to exist for highway sections carrying 2,000 to 2,999 vehicles per day, the narrowest pavement for sections carrying 1,000 to 1,499 vehicles per day, the greatest percentage of concrete or brick pavement for sections carrying 5,000 to 9,999 vehicles per day, the greatest number of restricted sight distances for sections carrying more than 10,000 vehicles per day, the greatest number of excessive grades per mile for sections carrying 1,000 to 1,499 vehicles per day (but only slightly more than the number occurring on sections carrying more than 10,000 vehicles per day), the greatest number of excessive curves per mile for sections carrying 1,000 to 1,499 vehicles per day, and the greatest number of fatal accidents per hundred million vehicle-miles for sections carrying 1,000 to 1,499 vehicles per day. The safest sections are those carrying more than 10,000 vehicles per day. They are by far the most congested, carrying 340 vehicles per day per foot of width. The sections which rank second in safety are those carrying less than 500 vehicles per day, or only 18 vehicles per day per foot of width.

Charts of similar form have been prepared for each of the 20 longer routes of the system. Their comparison with the summary chart for the entire system indicates, in general, that routes in the southern part of the country are more dangerous than northern routes.

From available data, it is not possible to compare the accident rate on the rural interregional system with that for all rural highways. The accident figures shown have been expressed in terms of the number of fatal accidents per 100 million vehicle-miles of travel on the system in 1937. On the rural interregional system there were 16.04 fatal accidents per 100 million vehicle-miles. It has been estimated that about 1.2 persons were killed in each fatal rural highway accident in 1937. Assuming that this rate applies to the rural interregional system, it implies a death rate of about 19.2 per 100 million vehicle-miles during 1937. The National Safety Council reports that in 1937 there were 15.8 deaths per 100 million vehicle-miles on all rural roads and urban streets.

PAVEMENT AND RIGHT-OF-WAY WIDTHS INADEQUATE

Figure 12 is a summary chart showing the accumulative distribution of right-of-way widths by traffic density groups. From it there can be read directly the percentage of the aggregate length of all rural sections which carry less than any chosen number of vehicles per day and which have right-of-way widths less than any chosen width. For example, if it is assumed that a right-of-way width of 160 feet is desired for all rural sections of the system carrying less than 3,000 vehicles per day, the length of the system requiring additional right-of-way is shown to be 79.5 percent of the aggregate length of all rural sections.

Similarly, figure 13 shows the cumulative distribution of pavement widths. If it is assumed that a pavement width of 22 feet is desired for all rural sections of the system carrying less than 1,000 vehicles per day (this is a liberal assumption for those roads that now carry less than 600 vehicles per day), the length of the system requiring additional pavement width is shown to be 30.1 percent of the aggregate length of all rural sections. If it is assumed that a pavement width of 24 feet is desired for all rural sections carrying less than 3,000 but more than 1,000 vehicles per day, the length requiring additional pavement width may be obtained by reading, on the vertical bar representing 24 feet, the intercept between the lines representing 1,000 and 3,000 vehicles per day. The length is shown to be 44.8 percent of the aggregate rural length.

A less direct use of figures 12 and 13 is the determination of the deficiency in the area of right-of-way or pavement for any desirable width for any traffic volume group. The area between the limits of the traffic volume group and to the left of the desired width is the deficient area which may easily be converted to acres or square yards.

There is no doubt that, as measured by the diagrams, unsatisfactory conditions with respect to sight distance, curvature, and gradient, are common. There is no doubt that present rights-of-way are largely inadequate. There seems to be generally a reasonable accord between traffic volume and the number of pavement lanes, the amount and character of the traffic, and the kind of pavement or surface in place, but there is inadequate width of pavement lanes on a considerable mileage, usually near cities. These inadequacies are the concomitant of construction operations carried on for more than 20 years, during which period top vehicle speeds have increased from 30 to well above 60 miles per hour. Then, too, when the oldest of the existing pavements were built there were only 2 or 3 million motor vehicles and there was a strong demand for hard surfaced roads to get the traffic through.

These conditions account for the present need for correction of sharp curvature, steep grades, and narrow surfaces and rights-of-way by reconstruction or by abandonment of such obsolete sections and relocating the highway.

The present need is to bring all of these interregional routes gradually up to a higher degree of usefulness by the reduction of excessive curvature, the easing of steep grades, the opening up of longer sight distances, the general widening of pavement lanes and the construction of additional lanes, the separation of opposing traffic on heavily traveled sections, arrangements for the accommodation of slow-moving traffic on steep grades, the separation of grades at railroad grade crossings and important highway intersections and the installation of protective cross traffic controls at others, the abatement of dangerous roadside conditions of all sorts, relocations for directness of travel between important objectives for serving the movements of longer range, and finally, the acquisition of new right-of-way of sufficient width to make all of these improvements possible.

During the next 20 years planning technique will be greatly improved. The determination of the required number of traffic lanes will probably not be determined on the basis of traffic density, but on the basis of some measures of traffic congestion, which will take into account the magnitude, duration, and frequency of occurrence of peak traffic loads, differences in speed of

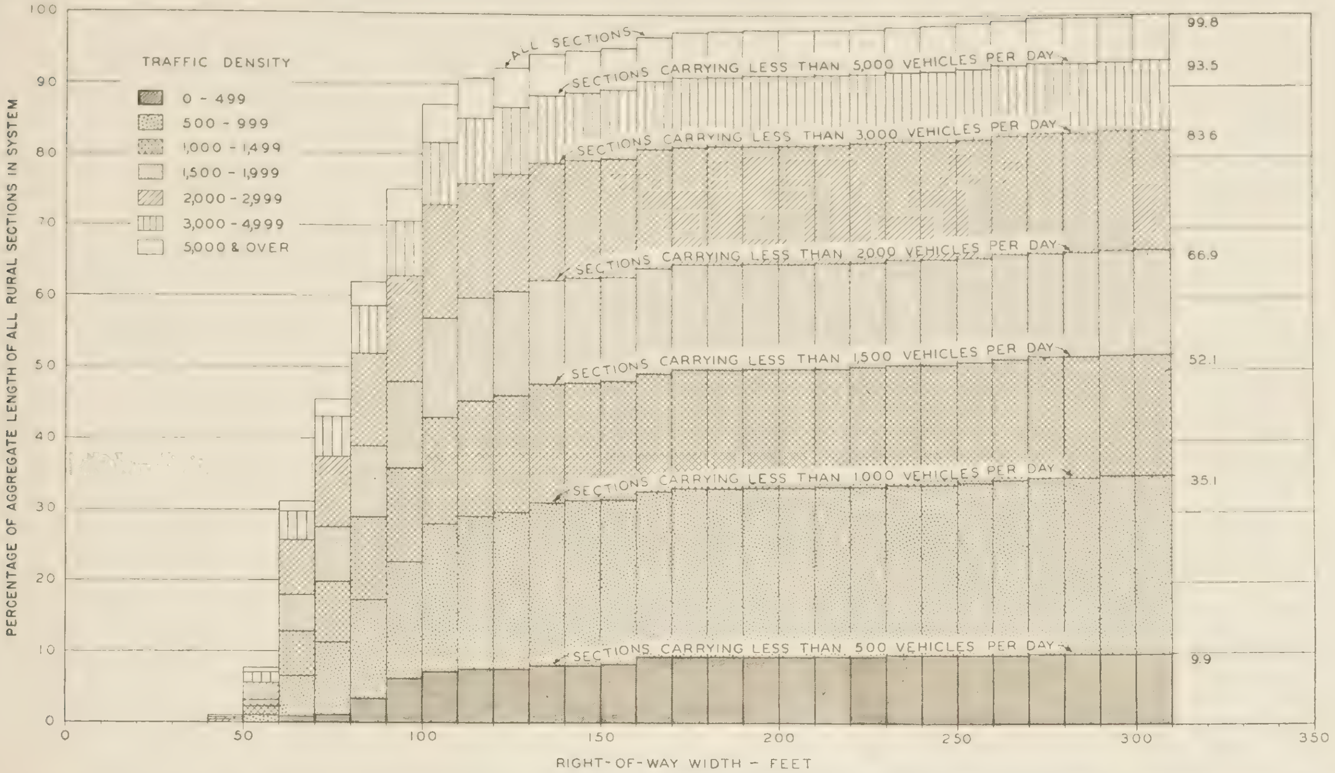

Figure 12.—Cumulative Distribution of Lengths of Rural Sections of the Tentatively Selected Interregional Highway System Having Various Right-of-Way Widths and Traffic Densities.

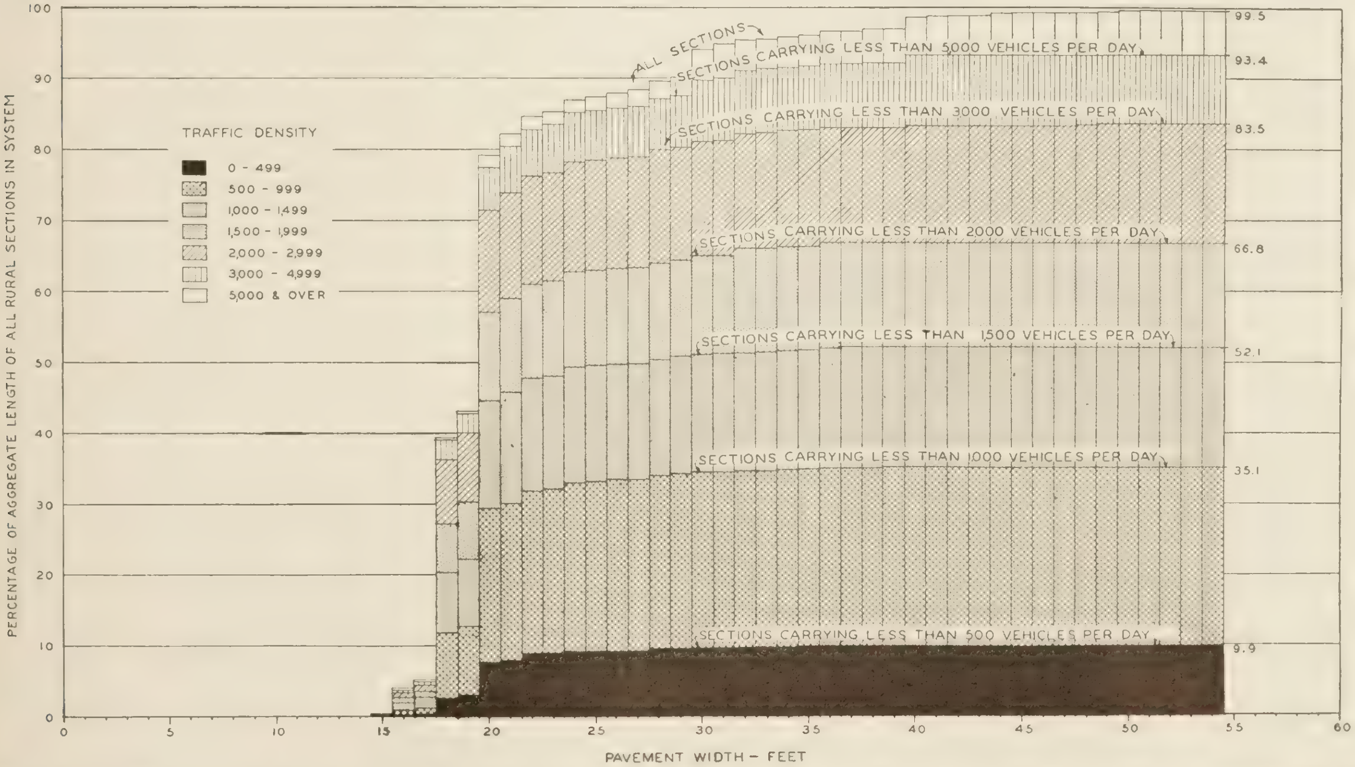

Figure 13.—Cumulative Distribution of Lengths of Rural Sections of the Tentatively Selected Interregional Highway System Having Various Pavement Widths and Traffic Densities.

travel, etc. Until uses of these measures of traffic congestion are perfected, the best basis for classification applicable to present available information is traffic density.

SECTIONS CLASSIFIED BY DAILY TRAFFIC VOLUME

For immediate planning purposes, all rural sections of the interregional system are classified into six groups as follows:

- Group I—Sections carrying less than 1,000 vehicles per day.
- Group II—Sections carrying 1,000 to 1,999 vehicles per day.
- Group III—Sections carrying 2,000 to 2,999 vehicles per day.
- Group IV—Sections carrying 3,000 to 4,999 vehicles per day.
- Group V—Sections carrying 5,000 to 9,999 vehicles per day.
- Group VI—Sections carrying 10,000 or more vehicles per day.

Design standards considered in this study of the interregional system are shown in table 3, and are based on the above classification of rural sections. The "present average daily traffic density" is considered to be the volume of traffic which follows the existing road immediately before the improvement is undertaken, plus the existing traffic then following other routes which would logically be diverted to the interregional road if the improvement were made. It does not include "generated traffic" which is generally defined as that traffic which results from a new desire for travel on the part of certain people who would not care to perform the same travel in the absence of the improved facility.

Groups I and II (traffic density 0–1,999) contain sections which cannot be expected to carry sufficient traffic to warrant construction to more than 2 lanes during the life of the new surface. The only difference in standards for sections in group I and those in group II is that a wider right-of-way is specified for the latter group. This additional right-of-way is justified by the improved protection to traffic and by the fact that high right-of-way costs can be avoided on those sections which will become inadequate from the standpoint of service in the shortest time, thus placing them in line for widening when the new surface must be replaced.

Practically all of the sections in group III (traffic density 2,000–2,999) will be due for construction as 4-lane divided highways when the life of the new surface has expired. Some of them will be ready for this higher type of construction before that time. The same right-of-way widths are specified for this group of sections as are specified for sections in group II.

All of the sections in group IV (traffic density 3,000–4,999) are assumed to carry sufficient traffic to warrant their construction as 4-lane divided highways.

Four-lane divided highway construction is also specified for sections in group V (traffic density 5,000–9,999), but greater cost allowances are provided for the attainment of the desirable standards, and more rigid limits are specified for the permissible standards. Many of these sections may require widening before the new surface needs replacement.

Sections in group VI (traffic density in excess of 10,000) are assumed to require special design, usually requiring more than a 4-lane divided highway.

The design standards marked "desirable" in table 3 apply wherever the average cost per mile for a section of any considerable length, exclusive of the costs of right-of-way, property damage, large bridges, and railroad and highway grade separation structures, does not exceed the amounts shown in column 4 headed "cost limitation, desirable standards." In order to provide flexibility in these standards, three subclassifications, based on topography of the terrain traversed, are

TABLE 3.—*Interregional highway standards*

Classification of section	Present average daily traffic density	Type of topography	Cost limitation, desirable standards	Right-of-way width [1]				Pavement widths [2]	Shoulder widths [3]				Width of normal median strip [3]				Curvature [6]		Grades	
				Minimum		Desirable			On embankments [4]		In excavation,[5] outside of curve or on tangent		Minimum permissible			Minimum desirable				
				Without border control	With border control	Without border control	With border control		Minimum permissible	Minimum desirable	Minimum permissible	Minimum desirable	Rural humid areas	Rural arid areas	Suburban areas		Maximum permissible	Maximum desirable	Maximum permissible	Maximum desirable
			Dollars	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Degree*	*Degree*	*Percent*	*Percent*
I	Less than 1,000	Relatively level	30,000	200	100	300	100	1–22	8	10	8	8	-----	-----	-----	-----	3	3	3	3
		Rolling	40,000	200	100	300	100	1–22	4	10	4	8	-----	-----	-----	-----	7	3	4.5	3
		Mountainous	60,000	200	100	300	100	1–22	4	10	4	8	-----	-----	-----	-----	10	3	6	3
II	1,000–1,999	Relatively level	40,000	200	[7] 160	300	[7] 160	1–24	8	10	8	8	-----	-----	-----	-----	3	3	3	3
		Rolling	60,000	200	[7] 160	300	[7] 160	1–24	4	10	4	8	-----	-----	-----	-----	7	3	4.5	3
		Mountainous	80,000	200	160	300	160	1–24	4	10	4	8	-----	-----	-----	-----	10	3	6	3
III	2,000–2,999	Relatively level	40,000	200	[7] 160	300	[7] 160	1–24	8	10	8	10	-----	-----	-----	-----	3	3	3	3
		Rolling	60,000	200	[7] 160	300	[7] 160	1–24	4	10	4	8	-----	-----	-----	-----	6	3	4	3
		Mountainous	80,000	200	160	300	160	1–24	4	10	4	8	-----	-----	-----	-----	8	3	5	3
IV	3,000–4,999	Relatively level	100,000	240	240	300	240	2–24	8	10	8	10	32	32	12	43	3	3	3	3
		Rolling	150,000	240	240	300	240	2–24	4	10	4	8	12	6	12	32	6	3	4	3
		Mountainous	200,000	240	240	300	240	2–24	4	10	4	8	6	6	6	25	8	3	5	3
V	5,000–9,999	Relatively level	225,000	240	240	300	240	2–24	8	10	8	10	32	32	12	43	3	3	3	
		Rolling	250,000	240	240	300	240	2–24	8	10	8	10	12	6	12	32	4	3	4	
		Mountainous	300,000	240	240	300	240	2–24	8	10	8	10	6	6	6	25	5	3	5	
VI	10,000 or more	Relatively level	(8)	(8)	(8)	(8)	(8)	(8)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	(9)	3	3	3	
		Rolling															4	3	4	
		Mountainous															5	3	5	

[1] Additional right-of-way to be provided where required to accommodate grading. Border control consists of State control of development of strip of land adjacent to the right-of-way for the purpose of eliminating objectionable features without necessarily preventing cultivation of arable land.

[2] Number and width of individual 2-lane pavements. All multiple parallel 2-lane pavements shall be separated by a median or dividing strip of land

[3] Design of shoulders and median or dividing strips shall be consistent with recommendations contained in A Policy on Highway Types, 1940.

[4] Exclusive of widening for guardrail.

[5] Inside of curves, maintain a uniform distance of 24 feet from centerline of 2-lane highway to toe of cut slope at ditch bottom, except unwidened curves on grade tangents where 22 feet will be permitted. Carry uniform slope from pavement edge to bottom of ditch. Provide comparable widths for 4-lane divided highways. Provide adequate foundation and stabilized surface for all shoulders.

[6] Vertical curves are to be designed as specified in the appendix.

[7] In relatively level and rolling terrain, 100 feet of this width should run continuously on 1 side of centerline.

[8] Special design.

[9] Not specified.

introduced, each carrying a specific cost limitation. These are designated "relatively level," "rolling," and "mountainous."

Wherever construction to desirable standards would exceed these amounts, the standards to be applied are relaxed, but not further than indicated in the columns headed "maximum" or "minimum," except in rare instances.

DESIGN STANDARDS DESCRIBED IN DETAIL

Right-of-way widths.—The desirable width of right-of-way for all rural sections is shown to be 300 feet, except where the principles of border control can be employed. Border control consists of State control of development of a strip of land adjacent to the right-of-way for the purpose of eliminating objectionable features without necessarily preventing cultivation of arable land. Agreements for such control may even include an option to buy the adjacent strips at some future time. Where border control can be obtained, the sum of the right-of-way width and the controlled width should be equal to the right-of-way widths shown in the columns headed "without border control." It should be noted that for 2-lane highways, the border control principle will permit reductions in required right-of-way widths to as little as one-third to one-half the width otherwise required, and on such highways, where old alinements are followed, the additional right-of-way width required would often be small.

Where right-of-way costs are abnormally high and border control principles cannot be employed, minimum widths are specified, consisting of 200 feet for 2-lane highways, and 240 feet for 4-lane divided highways.

Pavement widths.—Pavement widths are shown to be 22 feet for traffic densities of less than 1,000 vehicles per day, and 24 feet for traffic densities of 1,000 to 2,999. Divided highways having two roadways each 24 feet in width are specified for traffic densities of 3,000 to 9,999 vehicles per day.

Shoulder and median strip widths.—Shoulder widths of 8 feet in cut and 10 feet in fill are generally specified as desirable. Minimum requirements permit widths of 8 feet in terrain classified as relatively level, and 4 feet in terrain classified as rolling or mountainous.

The design of shoulders and median strips is to be consistent with recommendations contained in A Policy on Highway Types, published by the American Association of State Highway Officials.

Curvature and grades.—Curves of 3 degrees and grades of 3 percent are specified as desirable for all topography and all groups of highway sections and should control the design wherever the estimated cost is less than the limitations appearing in column 4 of table 3. In topography classified as relatively level, no departure from this requirement is permitted, even though the cost should exceed the limitation. For sections carrying less than 1,000 vehicles per day and located in mountainous country, 10-degree curves and 6-percent grades are specified. The standards become increasingly severe for more heavily traveled routes, reaching limits of 5 degrees and 5 percent for mountainous sections carrying more than 5,000 vehicles per day.

Sight distances.—The main controllable features of the highway which restrict sight distances may be classified as cut banks on horizontal curves, and hill crests. At night, sight distance is also limited by the rate of change of the profile elevations in sags, which affects the point at which headlamp rays strike the road surface. At the present time, specifications for lengths of vertical curves in sags are incomplete.

The limiting degree of horizontal curvature must usually be selected on the basis of a number of economic considerations, only one of which is the extent to which desirable sight distances can be provided. Once the specifications for horizontal alinement and cross sections are settled, the sight distances limited by cut banks on horizontal curves are fixed. Obviously, no advantage to the traveling public can be gained by increasing lengths of vertical curves occurring on horizontal curves beyond those lengths required to provide sight distance equal to that afforded by the horizontal curve. There is, therefore, no justification for construction expenditures for this purpose. For sections of the highway located on tangent and short horizontal curves where sight distance is not restricted by cut banks but by hill crests, vertical curves should be designed as described in the Appendix, page 95.

INTERREGIONAL STANDARDS COMPARED WITH EMERGENCY MILITARY STANDARDS

Highway grade separations are to be designed to conform with the recommendations contained in A Policy on Highway Types published by the American Association of State Highway Officials in 1940. For sections of the interregional highway carrying less than 3,000 vehicles per day and designed with two traffic lanes, grade separations are specified for all intersecting highways carrying more than 500 vehicles per day. Grade separations are also to be used at all railroad crossings. Intersecting roads carrying between 200 and 500 vehicles per day at the time the interregional improvement is constructed will cross at grade employing the design principles contained in A Policy on Highway Types and A Policy on Intersections at Grade.

For sections of the interregional system carrying between 3,000 and 10,000 vehicles per day and where a 4-lane divided highway is specified, grade separations are specified at all railroad intersections and at all intersecting highways carrying more than 200 vehicles per day. Intersecting roads carrying less than 200 vehicles per day will cross the interregional road at grade by means of special designs conforming to the recommendations contained in A Policy on Highway Types. For sections of the interregional system carrying more than 10,000 vehicles per day, grade separations are assumed for all railroad intersections and all intersecting highways left open for public use. Minor intersecting roads are to be closed to public use unless more than 200 vehicle-miles per day of additional travel are required for existing traffic to use an adjacent grade separation structure.

The foregoing discussion relates entirely to design standards for complete modernization of the interregional system. It will be interesting to compare these standards with the standards recently specified for emergency conditioning of principal routes of military importance. In these recent emergency standards provision is made for strengthening of weak bridges having ratings of less than H–15, widening of the narrowest bridges having horizontal clearance of less than 18 feet, increasing the vertical clearances of structures now having less than 12½ feet vertical clearance, widening pavements having surfaces less than 18 feet wide, widening shoulders to 8- or 10-foot widths wherever practical and improving surfaces which are not all-weather, dustless, or designed in accordance with present practice of individual States for repeated application of the 9,000-pound pneumatic wheel load.

The emergency standards provide for the improvement of all weak bridges to withstand H–15 loadings in rural areas and H–20 loadings in metropolitan areas. They provide for the increase of all vertical clearances less than 12½ feet to a minimum of 14 feet. Where pavement widening is necessary, specified new pavement widths are 20 feet for sections carrying less than 600 vehicles per day, 22 feet for sections carrying 1,600 to 1,799 vehicles per day, and 24 feet for sections carrying more than 1,800 vehicles per day. Where horizontal clearances on bridges are less than 18 feet, the standards specify their widening to a minimum of 4 feet in excess of the pavement widths specified, and preferably 6 feet in excess of these widths. Where horizontal clearances at underpasses are less than 18 feet, the standards specify their widening to a minimum of 30 feet, and preferably to a width equal to the new pavement widths specified plus shoulder widths.

Except in mountainous terrain where heavy grading is encountered, the standards specify the widening of all shoulders that are now less than 8 feet to a minimum width of 8 feet, and preferably to a width of 10 feet, wherever widening of shoulders can be undertaken economically. Where such widening is financially impractical or where sufficient right-of-way cannot be obtained without difficulty, the standards specify as a minimum requirement that 8- to 10-foot shoulders about 2,000 feet long be provided at 4-mile intervals on the same side of the highway. It is recommended in the standards that such intermittent shoulders be staggered on both sides in order to make emergency parking spaces available in one direction or the other at 2-mile intervals.

COST ESTIMATE BASED ON CLASSIFICATION OF SECTIONS IN ACCORDANCE WITH 1937 TRAFFIC DENSITY

For economic development, the improvement of the system must extend over a period of many years. Many existing sections improved to modern standards provide reasonably adequate service. The wisest course to follow is to improve each section to the interregional standards at the time when it can no longer continue to provide reasonably adequate service. On this basis, the worst sections will be improved first; therefore, sections in low traffic density groups as well as those in high traffic density groups will be placed under construction during the same year.

As the traffic density increases from year to year, the sections will progress from one traffic density group to another. An estimate of cost, therefore, based on a classification of sections in accordance with present-day traffic densities would be low as compared with one which must be developed to represent the actual expenditures required over a period of years. Nevertheless, for planning purposes, an estimate based upon traffic density classifications for a selected year has considerable value in that it can be subdivided by economic regions to show the relative cost, by regions (fig. 14), of the development proposed. These regional costs can be compared with various economic indices to test the soundness of the proposal, and particularly the distribution of the proposed work among the various regions.

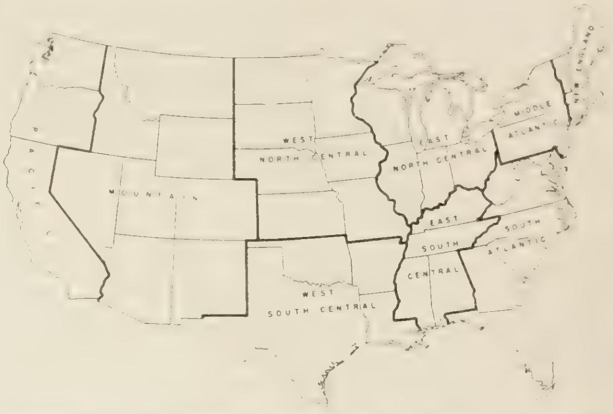

Figure 14.—Census Regions of the United States.

The cost of improving the rural sections of the interregional system to the design standards recommended, based upon a classification of sections in accordance with 1937 traffic densities, is shown in table 4. Grouped together are all rural sections in each geographic division for which the same number of traffic lanes are recommended. The estimated length of 2-lane sections is 21,237.3 miles, and the estimated construction cost is $1,149,404,000, or $54,100 per mile. The estimated length of 4-lane sections is 4,048.3 miles, and the estimated construction cost is $741,447,000, or $183,100 per mile. The estimated length of sections requiring special designs with more than 4 lanes is 268.6 miles, and the estimated construction cost is $117,887,000, or $438,900 per mile. Right-of-way

Table 4.—*Estimated cost of improving rural sections of the interregional system*

Geographic division	Less than 3,000 vehicles per day			3,000 to 10,000 vehicles per day			More than 10,000 vehicles per day			Total length	Total construction cost	15 percent allowance for engineering and contingencies	7.5 percent allowance for right-of-way	Total cost	Total cost per mile
	Length	Cost per mile	Estimated construction cost	Length	Cost per mile	Estimated construction cost	Length	Cost per mile	Estimated construction cost						
	Miles	*1,000 dollars*	*1,000 dollars*	*Miles*	*1,000 dollars*	*1,000 dollars*	*Miles*	*1,000 dollars*	*1,000 dollars*	*Miles*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*
New England	662. 2	70	46, 354	337. 2	192	64, 742	70. 3	464	32, 619	1, 069. 7	143, 715	21, 557	10, 779	176, 051	165
Middle Atlantic	383. 0	70	26. 810	699. 6	270	188, 892	102. 6	540	55, 404	1, 185. 2	271, 106	40, 666	20, 333	332, 105	280
East North Central	2, 072. 8	60	124, 368	720. 4	173	124, 629	4. 1	433	1, 775	2, 797. 3	250, 772	37, 616	18, 808	307, 196	110
West North Central	3, 516. 6	50	175, 830	233. 4	151	35, 243	4. 3	250	1, 075	3, 754. 3	212, 148	31, 822	15, 911	259, 881	69
South Atlantic	2, 442. 3	55	134, 326	541. 7	162	87, 755	45. 2	350	15, 820	3, 029. 2	237, 901	35, 685	17, 843	291, 429	96
East South Central	1, 873. 1	50	93, 655	128. 9	161	20, 753	-------	-------	-------	2, 002. 0	114, 408	17, 161	8, 581	140, 150	70
West South Central	3, 035. 6	50	151, 780	403. 2	130	52, 416	6. 2	300	1, 860	3, 445. 0	206, 056	30. 909	15, 454	252, 419	73
Mountain	5, 566. 9	50	278, 345	143. 0	133	19, 019	-------	-------	-------	5, 709. 9	297, 364	44, 605	22, 302	364. 271	64
Pacific	1, 684. 8	70	117, 936	840. 9	176	147, 998	35. 9	260	9, 334	2, 561. 6	275, 268	41, 290	20, 645	337. 203	132
United States	21, 237. 3	54	1, 149, 404	4, 048. 3	183	741, 447	268. 6	439	117, 887	25, 554. 2	2, 008, 738	301, 311	150, 656	2, 460, 705	96

TABLE 5.—*Estimated cost of improving urban sections of the interregional system*

Geographic division	Length	Construction cost per mile	Estimated construction cost	15 percent allowance for engineering and contingencies	25 percent allowance for right-of-way	Total cost	Total cost per mile
	Miles	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*
New England	227. 0	807	183, 189	27, 478	45, 797	256, 464	1, 130
Middle Atlantic	407. 1	1, 052	428, 269	64, 240	107, 067	599, 576	1, 473
East North Central	628. 4	537	337, 451	50, 618	84, 363	472, 432	752
West North Central	452. 5	385	174, 212	26, 132	43, 553	243, 897	539
South Atlantic	549. 9	385	211, 712	31, 757	52, 928	296, 397	539
East South Central	320. 9	365	117, 128	17, 569	29, 282	163, 979	511
West South Central	437. 6	319	139, 594	20, 939	34, 898	195, 431	447
Mountain	371. 5	275	102, 162	15, 324	25, 541	143, 027	385
Pacific	381. 6	548	209, 117	31, 368	52, 279	292, 764	767
United States	3, 776. 5	504	1, 902, 834	285, 425	475, 708	2, 663, 967	705

costs for rural sections are estimated to be 7.5 percent of the construction costs, and an allowance for engineering and contingencies equal to 15 percent of the construction cost is made.

The estimated cost of improving urban sections is shown in table 5. There are 3,776.5 miles of urban sections, representing 12.9 percent of the total length of the system The estimated construction cost is $1,902,834,000, or $503,900 per mile. Right-of-way costs are estimated to be 25 percent of this amount, and a further allowance of 15 percent of the construction cost is made for engineering and contingencies.

The estimated costs of urban sections are not sufficient to permit construction to theoretically ideal standards, but they are thought to be reasonable estimates of probable costs which would result from a general program aimed toward providing facilities as nearly approaching the ideal standards as practical, after reasonable compromises had been made. As one test of the consistency of the estimates for individual cities, the costs were reduced to a per capita basis. The estimates showed that per capita costs in large cities were lower than those in small cities. That this should be so is obvious when it is considered that the service rendered to a city by merely projecting the routes of the interregional system through it varies inversely with the population. This condition implies that attention should be directed to the need for extensive city development, which can be accomplished only in small part by the construction of the transcity connections of the interregional system. It emphasizes the fact that the larger the area of local congestion, the less is the amount of relief to be obtained merely by development of the system.

Even though the urban cost, including an allowance for right-of-way, exceeds the rural cost, this urban cost is estimated to be only about one-fifth of the expenditure which must be made to modernize completely all the main connecting thoroughfares in the cities traversed. Unless these additional and greater expenditures are made, the investment in the interregional route is threatened by the rapid obsolescence of urban portions of improved interregional routes which may be anticipated as a result of their attracting a disproportionately large share of traffic. This would probably lead to the outward development of the city further than would prove most economical to its interests. Only by construction of comparable facilities in other directions can the economic growth of cities, and the success of the interregional system itself, be assured.

In sharp contrast to the cost estimates for the improvement of the interregional system to recommended standards is the cost estimate for its improvement to the standards recently specified for the emergency improvement of principal routes of military importance. Table 6 shows that the estimated cost of improving rural sections to recommended standards is about six times the cost of improvement to emergency standards. Although a cost estimate on the latter basis was not prepared for urban sections, it would not seem unreasonable to assume that the same relationship would exist between estimates prepared for the urban sections as is shown for the rural sections.

DISTRIBUTION OF SYSTEM COMPARED WITH VARIOUS ECONOMIC INDICES

The report Toll Roads and Free Roads suggests that the routes of the system be selected "without specific limitation in each State." Although the system described in this paper was selected on the basis of present traffic service to population concentrations and with particular reference to interregional coverage, it may be well to present certain economic facts and see how the selected tentative system measures up to these facts.

TABLE 6.—*A comparison of the estimated cost of emergency work with the estimated cost of improvement to recommended long-range standards for rural sections of the interregional system*

Geographic division	Length of rural sections	Estimated construction cost of improving interregional system		Ratio of cost of emergency work to the cost based on long-range standards
		Using recommended long-range standards	Using standards recommended for emergency work	
	Miles	*1,000 dollars*	*1,000 dollars*	*Percent*
New England	1, 069. 7	143, 715	21, 799	15. 2
Middle Atlantic	1, 185. 2	271, 106	18, 548	6. 8
East North Central	2, 797. 3	250, 772	25, 690	10. 2
West North Central	3, 754. 3	212, 148	52, 206	24. 6
South Atlantic	3, 029. 2	237, 901	57, 170	24. 0
East South Central	2, 002. 0	114, 408	33, 220	29. 0
West South Central	3, 445. 0	206, 056	54, 351	26. 4
Mountain	5, 709. 9	297, 364	66, 116	22. 2
Pacific	2, 561. 6	275, 268	36, 557	13. 3
United States	25, 554. 2	2, 008, 738	365, 657	18. 2

Table 7 shows the population, area, national wealth, national income, cash farm income, value of manufactures, and value of mineral production, distributed by geographic divisions. Table 8 shows these same values expressed in terms of the percentage falling in each of the geographic divisions. Columns are included showing the portion of the length and the cost of the interregional system within each geographic division. The distribution is made on the basis of the rural sections, the urban sections, and also on the

TABLE 7.—*Selected economic data by geographic divisions*

Geographic division	Population 1940 [1]	Area 1930 [2]	National wealth 1936 [3]	National income 1937 [3]	Cash farm income 1939 [4]	Value of manufactures 1937 [5]	Value of mineral production 1937 [6]
		Square miles	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*
New England	8, 426, 566	61, 976	22, 615, 000	5, 459, 000	246, 500	5, 109, 927	24, 757
Middle Atlantic	27, 419, 893	100, 000	87, 613, 000	19, 209, 000	672, 600	16, 596, 004	708, 951
East North Central	26, 550, 823	245, 564	64, 841, 000	15, 978, 000	1, 540, 900	19, 971, 022	453, 745
West North Central	13, 490, 492	510, 804	29, 341, 000	6, 071, 000	1, 841, 000	4, 091, 727	417, 055
South Atlantic	17, 771, 099	269, 073	27, 049, 000	6, 979, 000	789, 600	5, 403, 450	406, 084
East South Central	10, 762, 967	179, 509	11, 479, 000	2, 858, 000	471, 800	1, 977, 318	220, 658
West South Central	13, 052, 218	429, 746	17, 363, 000	4, 569, 000	847, 200	2, 693, 027	1, 388, 412
Mountain	4, 128, 042	859, 009	10, 663, 000	1, 974, 000	506, 306	928, 951	543, 091
Pacific	9, 682, 781	318, 095	23, 517, 000	6, 322, 000	795, 100	3, 938, 627	510, 243
United States	131, 409, 881	2, 973, 776	294, 481, 000	69, 419, 000	7, 711, 000	60, 710, 053	4, 672, 996

[1] Preliminary figures issued by the United States Bureau of the Census, total includes 125,000 undistributed.
[2] Figures issued by the United States Bureau of the Census.
[3] National Industrial Conference Board Studies in Enterprise and Social Progress, pp. 62, 117.
[4] Crops and Markets, January 1940.
[5] United States Department of Commerce, report dated Jan. 31, 1940.
[6] Minerals Yearbook, 1939, p. 9.

TABLE 8.—*Geographical distribution of the length and estimated cost of the interregional system in relation to various economic indices*

Geographic division	Population 1940 [1]	Area 1930 [2]	National wealth 1936 [3]	National income 1937 [3]	Cash farm income 1939 [4]	Value of manufactures 1937 [5]	Value of mineral production 1937 [6]	Length of interregional system			Estimated cost of interregional system			Estimated cost of improving rural sections of system to "emergency" standards
								Rural sections	Urban sections	All sections	Rural sections	Urban sections	All sections	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
New England	6. 4	2. 1	7. 7	7. 9	3. 2	8. 4	0. 6	4. 2	6. 0	4. 4	7. 1	9. 6	8. 5	5. 9
Middle Atlantic	20. 9	3. 4	29. 7	27. 7	8. 7	27. 3	15. 2	4. 6	10. 8	5. 4	13. 5	22. 5	18. 2	5. 1
East North Central	20. 2	8. 2	22. 0	23. 0	20. 0	32. 9	9. 7	11. 0	16. 6	11. 7	12. 5	17. 7	15. 2	7. 0
West North Central	10. 3	17. 2	10. 0	8. 7	23. 9	6. 8	8. 9	14. 7	12. 0	14. 4	10. 6	9. 2	9. 8	14. 3
South Atlantic	13. 5	9. 0	9. 2	10. 1	10. 2	8. 9	8. 7	11. 9	14. 6	12. 2	11. 8	11. 1	11. 5	15. 6
East South Central	8. 2	6. 0	3. 9	4. 1	6. 1	3. 3	4. 7	7. 8	8. 5	7. 9	5. 7	6. 2	5. 9	9. 1
West South Central	9. 9	14. 5	5. 9	6. 6	11. 0	4. 4	29. 7	13. 5	11. 6	13. 2	10. 3	7. 3	8. 7	14. 9
Mountain	3. 2	28. 9	3. 6	2. 8	6. 6	1. 5	11. 6	22. 3	9. 8	20. 7	14. 8	5. 4	9. 9	18. 1
Pacific	7. 4	10. 7	8. 0	9. 1	10. 3	6. 5	10. 9	10. 0	10. 1	10. 1	13. 7	11. 0	12. 3	10. 0
United States	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0	100. 0

[1] Preliminary figures issued by the United States Bureau of the Census.
[2] Figures issued by the United States Bureau of the Census.
[3] National Industrial Conference Board Studies in Enterprise and Social Progress, pp. 62, 117.
[4] Crops and Markets, January 1940.
[5] United States Department of Commerce, report dated Jan. 31, 1940.
[6] Minerals Yearbook, 1939, p. 9.

basis of the rural and urban sections combined. For purposes of comparing the cost of the work that would be done in each region following the long-range recommended standards with the cost of the work that would be done following the emergency standards, the column on the extreme right has also been added which shows the distribution of the costs of the emergency work.

Figure 15 shows this same comparison graphically. To the left of the group of plotted values for each geographic division, the general economic indices are grouped. The value plotted to the extreme left is the percentage of the United States population that falls within the geographic division; next is the percentage of the area; third, the percentage of the national wealth; fourth, the percentage of the national income; fifth, the percentage of the national cash farm income; sixth, the percentage of the national value of manufactures, and finally, the percentage of the national value of mineral production. The next group of plotted values shows the percentage of the length of the interregional system falling within the geographic division. In this group, the value to the left represents the percentage of the length of all rural sections, and the one on the right represents the percentage of the total length including both rural and urban sections, and the mid-section represents the percentage of all urban sections. The third group of plottings shows the percentage of the estimated cost of the interregional system falling within the geographic division. The value to the left shows the percentage of the cost of all rural sections, and one on the right shows the percentage of the total cost including both rural and urban sections. The single value plotted on the extreme right for each geographic division represents the percentage of the estimated total cost of improvement of rural sections to emergency standards.

It will be noted that the distribution of mileage does not always compare favorably with the various economic indices. However, the distribution of costs of construction to long-range standards in all such cases tends to correct this condition. The level of the plotted values for rural costs alone is usually nearer the level of the economic indices, and the level of the plotted values for total costs is still nearer. The conclusion may be drawn that the system selected on the basis of present traffic service to population concentrations is well distributed on a general economic basis.

The levels of the plotted values representing the percentage distribution of the estimated cost of improvement of rural sections to emergency standards, when compared with the levels of the economic indices, is not so favorable. This is caused by the fact that in working to emergency standards, the same degree of improved service cannot be afforded throughout the country. Only the worst conditions can be remedied.

Table 9 shows the distribution to geographic divisions

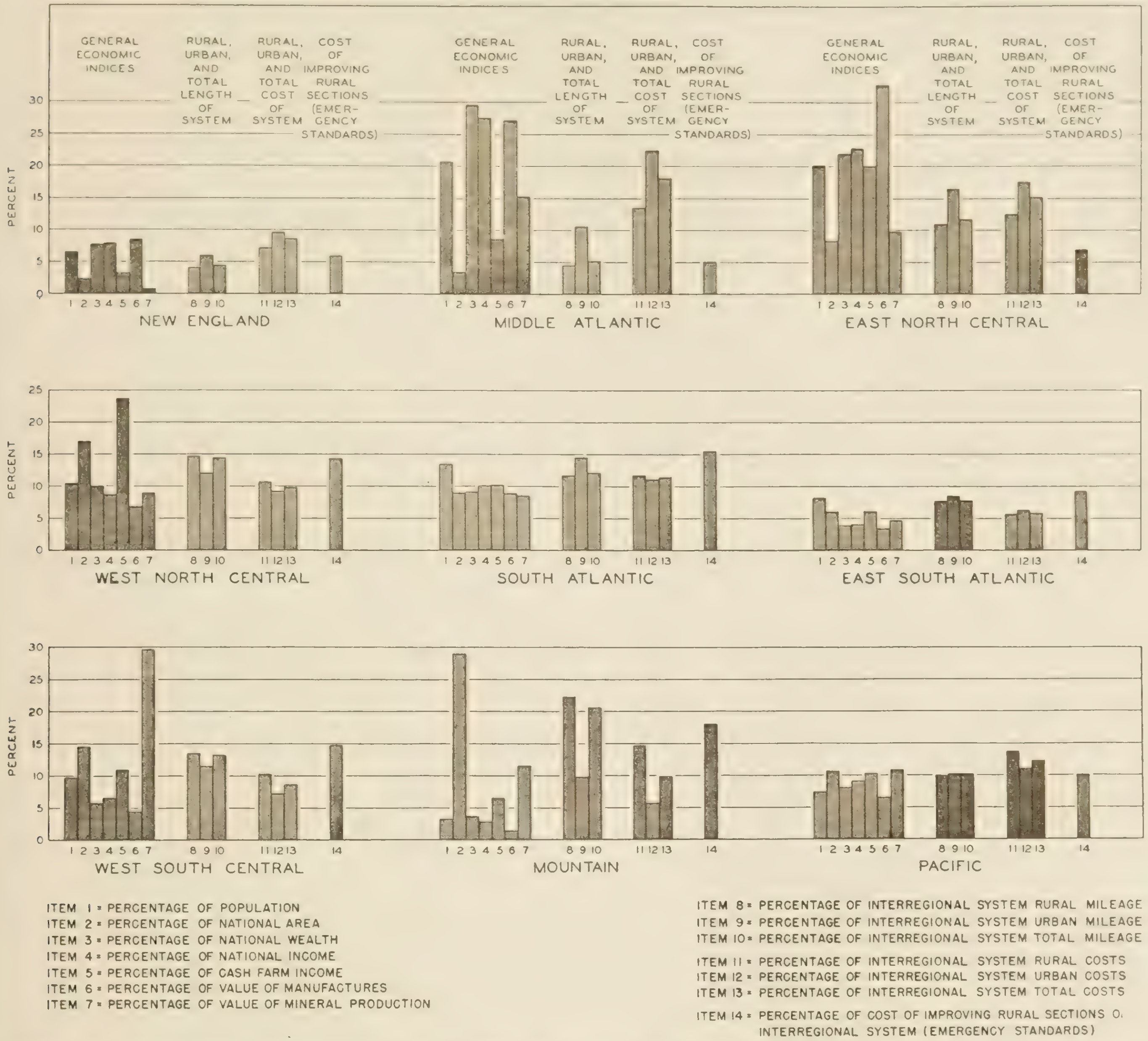

FIGURE 15.—GEOGRAPHICAL DISTRIBUTION OF THE LENGTH AND ESTIMATED COST OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM IN RELATION TO VARIOUS ECONOMIC INDICES.

TABLE 9.—*Pertinent highway facts and figures by geographic divisions*

Geographic division	Federal-aid apportionments 1941	Mileage of rural highways[1]	Mileage of urban streets and alleys [2]	Total mileage of roads, streets and alleys	Motor-vehicle registrations 1939 [3]	State highway income 1939 [4]
	1,000 dollars	*Miles*	*Miles*	*Miles*	*Vehicles*	*1,000 dollars*
New England	7, 134	82, 364	14, 591	96, 955	1, 944, 510	91, 450
Middle Atlantic	17, 781	187, 494	47, 802	235, 296	5, 813, 487	187, 911
East North Central	25, 364	438, 311	67, 033	505, 344	7, 078. 336	195, 464
West North Central	25, 390	765, 604	49, 706	815, 310	3, 862, 461	115, 000
South Atlantic	19, 754	333, 472	33, 288	366, 760	3, 274, 027	185, 365
East South Central	12, 190	238, 832	16, 758	255, 590	1, 458, 731	94, 041
West South Central	18, 486	380, 273	34, 128	414, 401	2, 800, 053	118, 104
Mountain	17, 253	333, 050	14, 178	347, 228	1, 210, 838	66, 260
Pacific	11, 010	194, 967	26, 336	221, 303	3, 565, 177	90. 469
United States	154, 362	2, 954, 367	303, 820	3, 258, 187	31, 007, 620	1, 144, 064

[1] Figures compiled in January 1941 by Public Roads Administration and based on latest inventory data or estimates furnished by the State-wide Highway Planning Surveys.

[2] Estimates compiled in January 1941 by Public Roads Administration from fiscal data collected by the State-wide Highway Planning Surveys.

[3] Figures include publicly owned, private and commercial motor vehicles. Figures do not include trailers, semitrailers, or motorcycles, nor 2,250 motor vehicles publicly owned and not registered in any State, compiled from reports of State authorities.

[4] Figures include transactions relating to debt service, operations of special bridge and grade separation authorities, expenditures of local authorities on State highways, and similar transactions.

TABLE 10.—*Geographical distribution of the length and estimated cost of the interregional system in relation to various highway factors*

Geographic division	Federal-aid apportionments 1941	Mileage of rural highways [1]	Mileage of urban streets and alleys [2]	Total mileage of roads, streets and alleys	Motor-vehicle registrations 1939 [3]	State highway income 1939 [4]	Length of interregional system			Estimated cost of interregional system			Estimated cost of improving rural sections of system to "emergency" standards
							Rural sections	Urban sections	All sections	Rural sections	Urban sections	All sections	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
New England	4.6	2.8	4.8	3.0	6.3	8.0	4.2	6.0	4.4	7.1	9.6	8.5	5.9
Middle Atlantic	11.5	6.3	15.7	7.2	18.7	16.4	4.6	10.8	5.4	13.5	22.5	18.2	5.1
East North Central	16.4	14.8	22.0	15.5	22.8	17.1	11.0	16.6	11.7	12.5	17.7	15.2	7.0
West North Central	16.5	25.9	16.4	25.0	12.5	10.1	14.7	12.0	14.4	10.6	9.2	9.8	14.3
South Atlantic	12.8	11.3	11.0	11.3	10.6	16.2	11.9	14.6	12.2	11.8	11.1	11.5	15.6
East South Central	7.9	8.1	5.5	7.8	4.7	8.2	7.8	8.5	7.9	5.7	6.2	5.9	9.1
West South Central	12.0	12.9	11.2	12.7	9.0	10.3	13.5	11.6	13.2	10.3	7.3	8.7	14.9
Mountain	11.2	11.3	4.7	10.7	3.9	5.8	22.3	9.8	20.7	14.8	5.4	9.9	18.1
Pacific	7.1	6.6	8.7	6.8	11.5	7.9	10.0	10.1	10.1	13.7	11.0	12.3	10.0
United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[1] Figures compiled in January 1941 by Public Roads Administration and based on latest inventory data or estimates furnished by the State-wide Highway Planning Surveys.

[2] Estimates compiled in January 1941 by Public Roads Administration from fiscal data collected by the State-wide Highway Planning Surveys.

[3] Figures include publicly owned, private, and commercial motor vehicles. Figures do not include trailers, semitrailers, motorcycles, or 2,250 motor vehicles publicly owned and not registered in any State, compiled from reports of State authorities.

[4] Figures include transactions relating to debt service, operations of special bridge and grade separation authorities, expenditures of local authorities on State highways and similar transactions.

of highway factors. These items include the 1941 Federal-aid apportionments, the total rural highway mileage, the mileage of urban streets and alleys, the total mileage of roads, streets, and alleys, the 1939 motor vehicle registrations, and the State highway departments' income in 1939. In table 10 these items are expressed in terms of the percentage which falls in each geographic division, and are compared with the portions of the length and the cost of the interregional system falling within each division. Figure 16 shows these same relationships graphically.

BOTH FREIGHT AND PASSENGER VEHICLES MAKE EXTENSIVE USE OF SYSTEM

Freight vehicles.—Close estimates of the use of the rural interregional highways by commercial freight vehicles and the tonnage hauled may be obtained for each State from the average daily commercial traffic per mile, the mileage of the system, the average load carried by commercial vehicles, and the percentage of total commercial vehicles that were loaded. All of these data are produced by the highway planning surveys.

Table 11 shows the mileage of rural interregional highways and the average daily ton-mileage of goods carried by commercial vehicles for each region. The commercial vehicle-mileage of loaded vehicles by States multiplied by average carried load is the basis of these estimates.

The relative use of rural interregional highways varies widely between regions of the country. In the Mountain Region average daily ton-miles per mile of highway are 314, as compared with 840 ton-miles per mile for the country as a whole. Vehicle loadings in the Mountain Region are not below average, but the number of commerical vehicles per mile is lower than in any other region.

In the West South Central Region (Arkansas, Louisiana, Oklahoma, and Texas) the average vehicle load is less than in the Mountain Region, but because the average number of commerical vehicles using the highways in the West South Central Region is higher, the average daily ton-miles per mile is larger than in the Mountain Region.

Ton-miles per mile are greatest in the East North Central Region (Ohio, Indiana, Illinois, Michigan, and Wisconsin). In this region the average number of commercial vehicles is high, and the average carried load per vehicle exceeds that in any other region.

TABLE 11.—*Estimated average daily ton-miles and ton-miles per mile on the tentative rural interregional system in 1938*

Geographic division	Miles	Average daily ton-miles	Daily ton-miles per mile
New England	1,070	1,300,595	1,215
Middle Atlantic	1,185	1,502,850	1,268
East North Central	2,797	4,232,944	1,513
West North Central	3,754	2,534,761	675
South Atlantic	3,029	3,696,614	1,220
East South Central	2,002	1,459,229	728
West South Central	3,445	2,004,491	581
Mountain	5,710	1,794,613	314
Pacific	2,562	2,930,045	1,144
United States	25,554	21,456,142	840

The average daily ton-miles for the country carried by motor vehicles on the tentative rural interregional system totals 21,456,000; on an annual basis the system is estimated to carry 7,831,000,000 ton-miles. Total truck ton-miles of carried load for all rural highways, exclusive of purely local haulage, are estimated at approximately 57 billion in 1939.[2] Thus, the rural interregional highway system, comprising 25,554 miles or less than 1 percent of the rural highway mileage of the United States, carries approximately 14 percent of the total truck ton-miles of carried load generated upon all rural highways.

Passenger cars.—Estimates of the use of the rural interregional highways by passenger cars are obtained from the highway planning surveys. These data are presented in table 12, together with a compilation of the passenger-car miles per mile.

As in the case of freight vehicles, the use of the tentative rural interregional system by passenger cars varies widely by regions; in fact, the variation between regions is much wider than in the case of freight vehicles. In the South Atlantic Region, for example, freight-

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[2] Estimated from data furnished by the highway planning surveys.

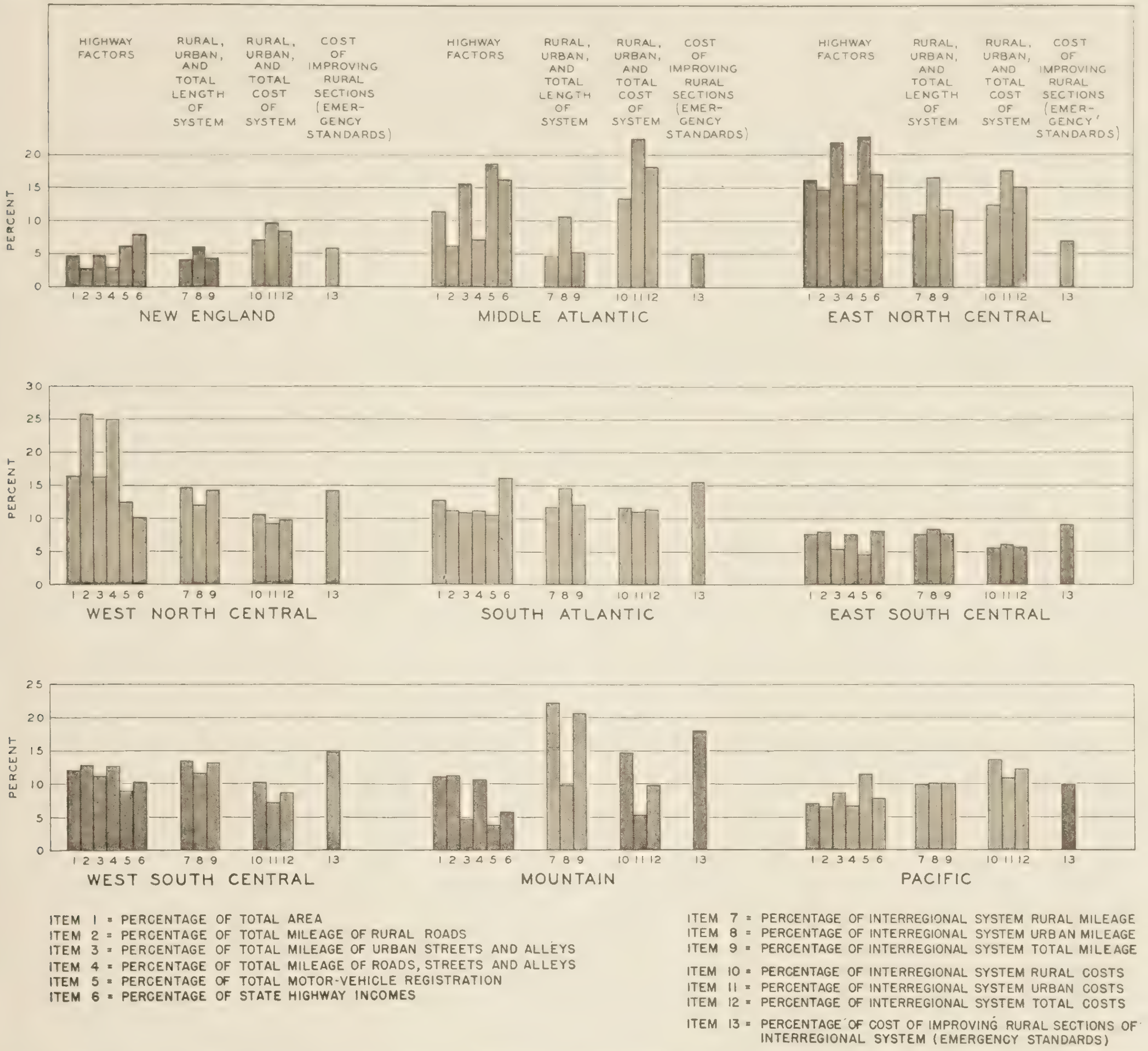

FIGURE 16.—GEOGRAPHICAL DISTRIBUTION OF THE LENGTH AND ESTIMATED COST OF THE TENTATIVELY SELECTED INTERREGIONAL HIGHWAY SYSTEM IN RELATION TO THE GEOGRAPHICAL DISTRIBUTION OF VARIOUS HIGHWAY FACTORS.

vehicle use per mile of the interregional system is 45 percent more than the average for the United States, while passenger-car use per mile in the South Atlantic Region is but 13 percent more than the average for the United States.

Again, in the Middle Atlantic Region the passenger-car use per mile exceeds the average for the Nation by 154 percent, while freight-vehicle use per mile exceeds the average for the Nation by but 51 percent.

Thus, the road use by freight vehicles, although the range is considerable, tends to be much more uniformly distributed by regions than is the case in passenger-car use.

Total passenger-car miles in 1938 for all rural roads in the United States, derived from the road-use surveys, are estimated at 146 billion. Passenger-car use of the interregional system, from table 12, is 14,948 million passenger-car miles, or approximately 10 percent of passenger-car use of all rural roads of the country.

TABLE 12.—*Estimated average daily passenger-car miles and passenger-car miles per mile on the tentative rural interregional highway system in 1938*

Geographic division	Miles	Average daily passenger-car miles	Passenger-car miles per mile[1]
New England	1, 070	3, 024, 787	2, 827
Middle Atlantic	1, 185	4, 833, 445	4, 079
East North Central	2, 797	5, 655, 758	2, 022
West North Central	3, 754	4, 594, 484	1, 224
South Atlantic	3, 029	5, 485, 726	1, 811
East South Central	2, 002	2, 461, 876	1, 230
West South Central	3, 445	4, 844, 882	1, 406
Mountain	5, 710	4, 073, 109	713
Pacific	2, 562	5, 979, 161	2, 334
United States	25, 554	40, 953, 228	1, 603

[1] Does not include busses. Variation in bus loading and the fact that busses are less than 1 percent of all vehicles make estimates of bus-miles impractical.

Table 13.—*Motor-vehicle taxes and other highway-user costs, 1934–39* [1]

Year	Net total motor-fuel tax receipts [2]	Motor-vehicle registration receipts [3]	Motor-carrier tax receipts [4]	Federal excise taxes paid by highway users [5]	Bridge and tunnel tolls [6]	Ferry tolls [6]	Total [7]
	1,000 dollars	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*	*1,000 dollars*
1934	566, 642	307, 260	9, 402	235, 743	46, 693	15, 151	1, 180, 891
1935	619, 677	322, 974	12, 421	256, 671	49, 375	16, 021	1, 277, 139
1936	691, 420	359, 783	15, 137	297, 142	53, 600	17, 392	1, 434, 474
1937	761, 998	399, 613	16, 216	326, 515	57, 082	18, 522	1, 579, 946
1938	771, 764	388, 825	16, 421	267, 959	57, 424	18, 633	1, 521, 026
1939	821, 656	412, 494	18, 055	320, 373	60, 621	19, 670	1, 652, 869

[1] Compiled by Public Roads Administration.
[2] Figures include distributors' and dealers' licenses, inspection fees, fines and penalties, and other similar miscellaneous receipts.
[3] Figures include motor-vehicle registration fees, dealers' license plates, operators' and chauffeurs' permits, certificates of title, special titling taxes, fines and penalties, transfers or registration fees, and other similar miscellaneous receipts.
[4] Figures include receipts from gross receipt taxes; mileage, ton-mile and passenger-mile taxes; weight, capacity or flat-rate taxes, certificate or permit fees, caravan taxes, and other similar miscellaneous receipts.
[5] Figures include the estimated portion of taxes on gasoline paid by highway users (90.5 percent), the estimated portion of taxes on lubricating oil paid by highway users (58.0 percent) and the taxes collected on tires, tubes, automobiles, motorcycles, trucks, parts, and accessories.
[6] Figures compiled for year of 1937 and estimates for previous and later years made on the basis of the relative values of gasoline consumption and motor-vehicle registration for these years.
[7] Totals do not include road tolls, municipal or county fees or licenses applicable to motor vehicles, or personal property taxes on motor vehicles. Reliable estimates of these figures were not available.

Table 14.—*Percentage of motor-vehicle taxes and other highway user costs for 1934 to 1939 from each source* [1]

Year	Net total motor-fuel tax receipts [2]	Motor-vehicle registration receipts [3]	Motor-carrier tax receipts [4]	Federal excise taxes paid by highway users [5]	Bridge and tunnel tolls [6]	Ferry tolls [6]	Total [7]
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
1934	48. 0	26. 0	0. 8	20. 0	4. 0	1. 2	100. 0
1935	48. 5	25. 3	1. 0	20. 0	3. 9	1. 3	100. 0
1936	48. 2	25. 1	1. 1	20. 7	3. 7	1. 2	100. 0
1937	48. 2	25. 3	1. 0	20. 7	3. 6	1. 2	100. 0
1938	50. 7	25. 6	1. 1	17. 6	3. 8	1. 2	100. 0
1939	49. 7	24. 9	1. 1	19. 4	3. 7	1. 2	100. 0
Average	49. 0	25. 3	1. 0	19. 7	3. 8	1. 2	100. 0

[1] Compiled by Public Roads Administration.
[2] Figures include distributors' and dealers' licenses, inspection fees, fines, and penalties, and other similar miscellaneous receipts.
[3] Figures include motor-vehicle registration fees, dealers' license plates, operators' and chauffeurs' permits, certificates of title, special titling taxes, fines and penalties, transfers or registration fees, and other similar miscellaneous receipts.
[4] Figures include receipts from gross receipt taxes; mileage, ton-mile and passenger-mile taxes; weight, capacity or flat-rate taxes; certificate or permit fees; caravan taxes; and other similar miscellaneous receipts.
[5] Figures include the estimated portion of taxes on gasoline paid by highway users (90.5 percent), the estimated portion of taxes on lubricating oil paid by highway users (58.0 percent) and the taxes collected on tires, tubes, automobiles, motorcycles, truck, parts, and accessories.
[6] Figures compiled for year of 1937 and estimates for previous and later years made on the basis of the relative values of gasoline consumption and motor-vehicle registration for these years.
[7] Totals do not include road tolls, municipal or county fees or licenses applicable to motor vehicles, or personal property taxes on motor vehicles. Reliable estimates of these figures were not available.

MOTOR-VEHICLE TAXES AMOUNT TO 0.582 CENTS PER VEHICLE-MILE

A highway, like an automobile, earns nothing except when used for transportation service. The more the road is used, the greater are its earnings. These earnings come from various highway-user charges, the more important of which are the motor-fuel taxes, registration fees, and Federal excise taxes. Motor-carrier taxes and tolls comprise a small portion of the cost of operating motor vehicles over the highways. Tables 13 and 14 show these data for the years 1934 to 1939, inclusive.

While the data contained in these two tables are useful for the country as a whole, there is no published information showing the earning power of individual roads. Such information must be calculated from various data such as the vehicle-miles of travel on the road, gallons of gasoline consumed, the rate of gasoline taxes, and the relation between gasoline taxes and other motor-vehicle taxes.

The Public Roads Administration has estimated that in 1939 there was a total of 287,747.5 million vehicle-miles of travel by all kinds of motor vehicles, and that the gasoline consumed amounted to 22,685,056,000 gallons, of which motor vehicles utilized 91.40 percent, or 20,735,120,000 gallons. On this basis a motor vehicle traveled on the average 13.88 miles while consuming 1 gallon of gasoline. This mileage figure represents a weighted average of gasoline consumption by all kinds of motor vehicles used on city streets and on highways.

From table 14 it is shown that the average of the gasoline tax during the 6 years, 1934–39, constituted 49.0 percent of all motor-vehicle taxes for those years. The Public Roads Administration has also calculated that the weighted average State gasoline tax for the country in 1939 was 3.96 cents per gallon. On this basis the total motor-vehicle taxes collected on a motor vehicle while consuming 1 gallon of gasoline amount to 8.08 cents. By dividing the total taxes collected on a motor vehicle while consuming 1 gallon of gasoline by the total distance traveled, the total tax burden on a motor vehicle per mile is obtained. This amounts to 0.582 cent.

Table 15 shows the annual earnings of rural sections of the tentative interregional system grouped in accordance with geographic divisions and 1937 traffic densities, based upon this rate of 0.582 cent per vehicle-mile. A more detailed study of tax rates by regions would make possible some refinement of the regional earnings.

The earnings have been reduced to a per mile basis in order to compare later the annual cost of each section with its earning capacity.

The annual earnings during the lifetime of an im-

TABLE 15.—*Approximate earnings*[1] *of rural sections of the interregional highway system for the year 1937*

Geographic division	Sections carrying less than 3,000 vehicles per day				Sections carrying more than 3,000 vehicles but less than 10,000 vehicles per day				Sections carrying 10,000 or more vehicles per day				All sections			
	Length	Daily traffic	Annual earnings		Length	Daily traffic	Annual earnings		Length	Daily traffic	Annual earnings		Length	Daily traffic	Annual earnings	
			Total	Per mile			Total	Per mile			Total	Per mile			Total	Per mile
	Miles	*1,000 vehicle-miles*	*1,000 dollars*	*Dollars*	*Miles*	*1,000 vehicle-miles*	*1,000 dollars*	*Dollars*	*Miles*	*1,000 vehicle-miles*	*1,000 dollars*	*Dollars*	*Miles*	*1,000 vehicle-miles*	*1,000 dollars*	*Dollars*
New England	662.2	690	1,466	2,210	337.2	2,038	4,329	12,840	70.3	1,103	2,343	33,330	1,069.7	3,831	8,138	7,610
Middle Atlantic	383.0	808	1,716	4,480	699.6	3,682	7,822	11,180	102.6	1,205	2,560	24,950	1,185.2	5,695	12,098	10,210
East North Central	2,072.8	3,915	8,317	4,010	720.4	3,193	6,783	9,420	4.1	45	96	23,410	2,797.3	7,153	15,196	5,430
West North Central	3,516.6	4,761	10,114	2,880	233.4	1,047	2,224	9,530	4.3	53	113	26,280	3,754.3	5,861	12,451	3,320
South Atlantic	2,442.3	3,848	8,174	3,350	541.7	2,579	5,479	10,110	45.2	630	1,338	29,600	3,029.2	7,057	14,991	4,950
East South Central	1,873.1	2,729	5,797	3,090	128.9	541	1,149	8,910	------	------	------	------	2,002.0	3,270	6,946	3,470
West South Central	3,035.6	4,489	9,536	3,140	403.2	1,667	3,541	8,780	6.2	66	140	22,580	3,445.0	6,222	13,217	3,840
Mountain	5,566.9	4,494	9,547	1,710	143.0	600	1,275	8,920	------	------	------	------	5,709.9	5,094	10,822	1,900
Pacific	1,684.8	2,334	4,958	2,940	840.9	4,344	9,228	10,970	35.9	396	841	23,430	2,561.6	7,074	15,027	5,870
United States	21,237.3	28,068	59,625	2,810	4,048.3	19,691	41,830	10,330	268.6	3,498	7,431	27,670	25,554.2	51,257	108,886	4,260

[1] The earnings are based on a rate of 0.582 cent per vehicle-mile, which is the estimated rate for the period 1934–39.

provement greatly exceed the present earnings of an existing highway because of diverted traffic, generated traffic, and the normal rate of increase in traffic. The extent of the influence of each of these three factors will vary considerably with the region, the proximity to urban areas, the type of service rendered, etc. Such variations must be ignored in this paper, and general assumptions must be made for the country as a whole. It seems conservative to estimate that at the time an average rural section is improved to rural standards, the increase in traffic resulting from diversion would be approximately 10 percent, and generated traffic would be approximately 5 percent of the existing traffic. During the lifetime of the improvement, assuming an average life of 30 years, the normal rate of increase in traffic should be such that the average traffic during the entire period should be at least 50 percent greater than the traffic using it during the first year the improved facility is in operation. The average traffic during the lifetime of the improvement would, on the basis of these assumptions, be equal to 150 percent times 110 percent times 105 percent of the traffic using the existing highway, or approximately 173 percent.

The design standards to be applied are controlled by the traffic density of the particular section, adjusted to include traffic which will be diverted to the improvement. The improvements on the system are to extend over a period of years, and the distribution of the rural sections among the various traffic-density groups will shift materially by the time reconstruction of all sections has taken place. Some of the sections constructed in later years would still have earnings comparable with improvement costs after the life of some of the first sections had expired. For these reasons, the total earning capacity of the system would have to be estimated on a very complicated basis, requiring many assumptions. However, the total earning capacity of the system need not be known in comparing the costs with the earnings. If it can be shown that there is a favorable ratio of earnings to costs for any section regardless of which traffic density group it may happen to fall in at the time of its improvement, the ratio of earnings to costs for the system would also have to be favorable.

For a section falling within any one of three major traffic density groups, when classified on the basis of its traffic density, adjusted to include diverted traffic, the average annual earnings per mile and per vehicle-mile during the lifetime of the improvement are shown in table 16, it being assumed that the influence of generated traffic and the normal rate of increase combined would be equal to 105 percent times 150 percent or 157 percent. In this same table there is also shown the amount to which these earnings would accumulate during a period of 30 years, which is assumed to be the average life of the improvements. These earnings per mile would, of course, shift to higher or lower levels if the improvement program were carried on in such a manner that the average adjusted initial traffic density of all sections selected for improvement within any density group were allowed to depart from the 1937 determined average traffic density of that group. An increase can hardly be avoided for the lower traffic density group, but, theoretically, the levels for the intermediate and high traffic density groups could be maintained. Difficulties arising from shifts in levels can be avoided by confining appraisals of earnings to a vehicle-mile basis. The vehicle-mile basis also applies just as well to one geographic division as to another, whereas the earnings per mile within any density group for a geographic division and for the 30-year period following improvement cannot be estimated reliably without exhaustive study.

TABLE 16.—*Average earnings of rural sections of the tentative interregional highway system*[1]

Initial traffic density adjusted to include traffic which would be attracted by the improvement	Annual earnings for adjusted initial traffic density		Average annual earnings for 30-year period after improvement		Total earnings for 30-year period after improvement	
	Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles
Less than 3,000	$2,810	$5.82	$4,410	$5.82	$132,300	$5.82
3,000–9,999	10,330	5.82	16,220	5.82	486,600	5.82
10,000 and over	27,670	5.82	43,440	5.82	1,303,200	5.82

[1] It is assumed that the average traffic density for the 30-year period will be 157 percent of the initial traffic density adjusted to include traffic which would be attracted by the improvement.

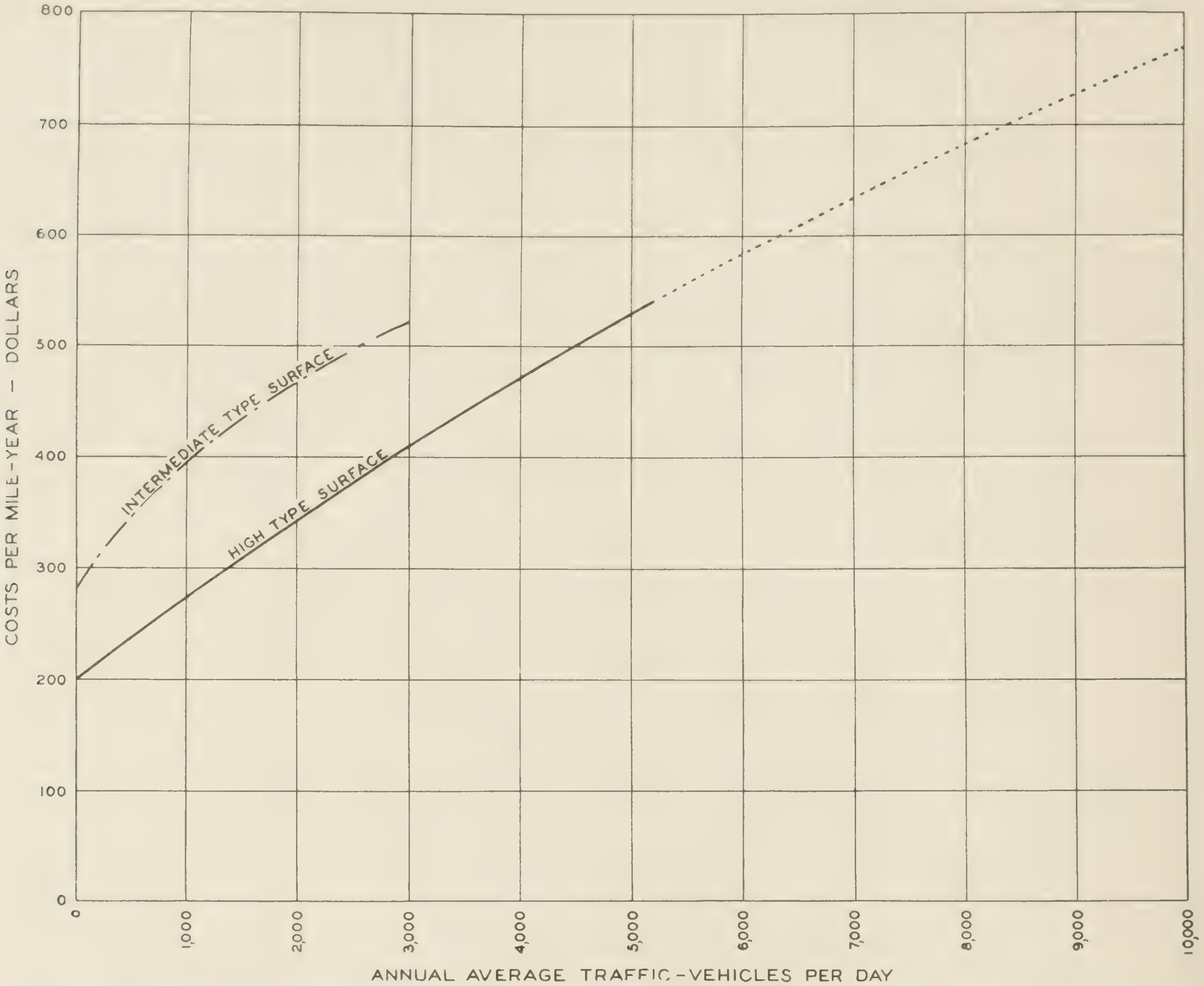

Figure 17.—Average Maintenance Costs Per Mile for Various Traffic Densities.

IMPROVEMENT, MAINTENANCE, AND OPERATION COSTS DISCUSSED

The estimated cost of improving and operating the system must include suitable allowances for administration, maintenance, operation, and policing, in addition to the cost of the improvements. The cost of improvements actually includes the initial cost, the cost of emergency reconstruction caused by floods, slides, etc., the cost of widening some of the sections where the rate of traffic increase is abnormally high, etc. Allowances for these various classes of construction may be made either in a direct manner or they may be made by considering the average life of the improvements to be a little shorter than the anticipated life of those sections not requiring any reconstruction. The latter basis is preferred, and it is assumed that an average life of 30 years for sections built to the recommended standards is reasonable for the shortened life.

Estimated maintenance costs are based on the unit costs shown in figures 17 and 18. These curves were drawn through the field of points obtained by plotting the maintenance cost data reported in Public Aids to Transportation, Volume IV.[3] The curves for the intermediate-type roads were carried no further than the 3,000 average traffic density ordinate, because it is assumed that any intermediate type surfaces would not be placed on sections carrying more than this number of vehicles. The portion of the curves for the high-type surfaces shown by means of dashed lines was projected for high-traffic densities beyond the range of the plotted points.

The curves should not be considered applicable to 4-lane highways but merely as indicative of the extent to which maintenance costs on 2-lane highways vary with traffic densities up to 5,500 vehicles per day. Beyond this traffic density the dashed curves should be regarded as theoretical projections of the trend in the maintenance costs which might logically be used as a measure of the rate of change in maintenance costs on 4-lane divided highways. The 4-lane highway maintenance costs would obviously be at some higher level. Considering the fact that most of the heavier traveled sections requiring 4-lane treatment will be located where more than usual attention must be paid

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[3] Published by Section of Research, Federal Coordinator of Transportation, 1940.

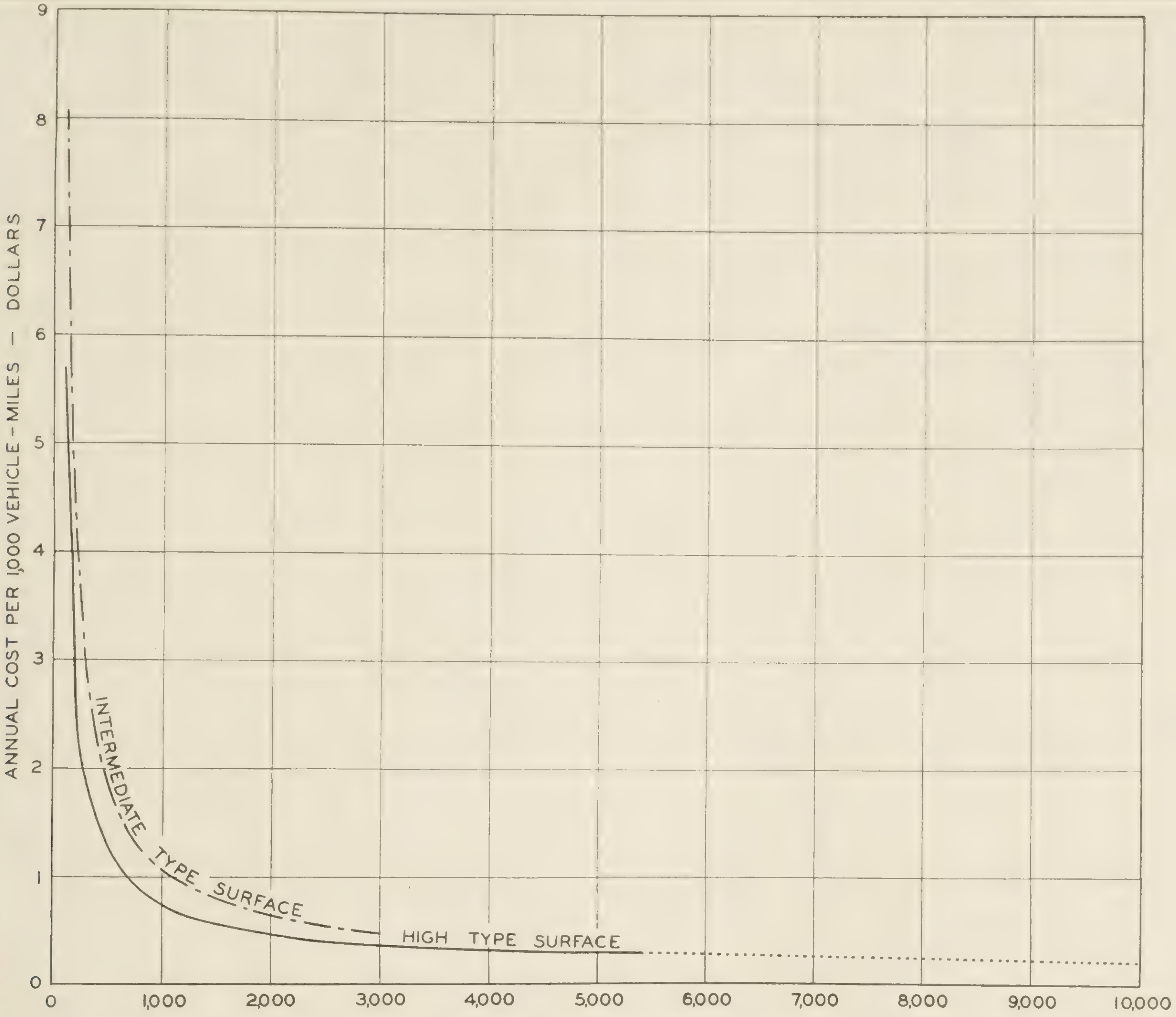

Figure 18.—Average Maintenance Costs Per Vehicle-Mile for Various Traffic Densities.

to landscaping, it has been assumed that the amounts indicated by the curves based on 2-lane maintenance costs should be doubled. For highway sections carrying more than 10,000 vehicles per day where special design is recommended, amounts equal to two and one-half times those indicated by curves based on 2-lane maintenance costs have been assumed.

In selecting from the curves a value that is applicable for the life of an improvement, it is necessary to select the value corresponding with the average traffic density during the period of service and not the value for the traffic density at the time of the improvement. In accordance with assumptions made in the calculation of the earning power of the system, the traffic density controlling the selection of the maintenance cost should be 157 percent of the initial traffic density adjusted to include divertable traffic. For values selected for traffic densities of less than 3,000, a point lying somewhere between the two curves should be selected.

Table 17 shows the estimated maintenance and operation cost during the life of the improvement based upon values obtained from the curves shown in figures 17 and 18. An allowance for policing equal to 15 percent of the maintenance and operation cost is made and an allowance of 5 percent of the total construction and maintenance expenditures is made for administration and overhead.

For a section falling within any one of three major traffic density groups, when classified on the basis of its traffic density adjusted to include diverted traffic, the cost per 1,000 vehicle-miles and the average annual and total costs per mile during the lifetime of the improvement are shown in table 18. As in the case of the earnings similarly shown in a previous table, the costs per vehicle-mile would shift to higher or lower levels if the improvement program were carried on in such a manner that the average initial traffic density of all sections selected for improvement within any density group were to depart from the 1937 determined average traffic density of that group. However, in contrast to the tendency for the earnings per mile to increase, a decrease can hardly be avoided in the costs per vehicle-mile for the lower traffic density groups, but it would be possible to maintain the levels in the other groups. The effect of any probable change of levels will always be to improve the relationship between earnings and costs, as can be shown by comparison of the estimated earnings and the estimated costs shown in this paper.

TABLE 17.—*Average costs of improving and operating rural sections of the tentative interregional system*

Initial traffic density adjusted to include traffic which would be attracted by the improvement	Initial cost [1] of of the improvement per 1,000 vehicle-miles of travel during the 30-year period	Maintenance and operation costs, including policing, per 1,000 vehicle-miles of travel during the 30-year period	Administration costs per 1,000 vehicle-miles of travel during the 30-year period	Average annual cost of improvement and operation during the 30-year period		Total cost of improvement and operation during the 30-year period	
				Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles
Less than 3,000	$2.92	$0.55	$0.17	$2,760	$3.64	$82,800	$3.64
3,000–9,999	2.68	.55	.16	9,460	3.39	283,800	3.39
10,000 and over	2.40	.39	.14	21,900	2.93	657,000	2.93

[1] Includes allowances for right-of-way engineering, and contingencies.

TABLE 18.—*Estimated maintenance and operation costs for rural sections of the tentative interregional system* [1]

Initial traffic density adjusted to include traffic which would be attracted by the improvement	Annual costs for adjusted initial traffic density		Average annual costs during 30-year period after improvement		Total costs during 30-year period after improvement	
	Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles	Per mile	Per 1,000 vehicle-miles
	Dollars	*Cents*	*Dollars*	*Cents*	*Dollars*	*Cents*
Less than 3,000	320	66.336	362	47.798	10,860	47.798
3,000–9,999	1,040	58.580	1,330	47.716	39,900	47.716
10,000 and over	2,150	45.227	2,550	34.167	76,500	34.167

[1] It is assumed that the average traffic density for the 30-year period will be 157 percent of the initial traffic density adjusted to include traffic which would be attracted by the improvement.

SUMMARY

Table 19 shows a comparison of the estimated earnings during a 30-year period with the total estimated costs during a 30-year period, which is assumed to be the average life of a section improved to the recommended standards. This is the picture that is obtained when improvements are financed on a "pay as you go" basis, from current revenues, and are undertaken after the present improvement has paid for itself and is due for reconstruction. Obviously, other relationships would exist if new improvements were to be financed by other methods or if new improvements were to be undertaken before the present improvements had served their economic life. If the whole program were to be undertaken at once, financing charges would have to be included in the costs, and earnings required to liquidate the unretired balance of the investments in existing improvements would have to be subtracted from the earnings. These two operations would narrow or possibly wipe out the excess earnings of the system.

Before these excess earnings, shown in table 19, excite too much enthusiasm for the interregional highway system proposal, and before they invite false conclusions as to the advisability of proceeding immediately with a great portion of the work financed by borrowed money, careful consideration must be given to their true meaning.

TABLE 19.—*Comparison of costs and earnings of rural sections of the tentative interregional system*

Initial traffic density adjusted to include traffic which would be attracted by the improvement	Total cost of improvement and operation during the 30-year period		Total earnings during the 30-year period		Excess of earnings over costs during the 30-year period		Ratio of costs to earnings during the 30-year period
	Per mile	Per 1,000 vehicle miles	Per mile	Per 1,000 vehicle miles	Per mile	Per 1,000 vehicle miles	
							Percent
Less than 3,000	$82,800	$3.64	$132,300	$5.89	$49,500	$2.25	63
3,000–9,999	283,800	3.39	486,600	5.89	202,800	2.50	58
10,000 and over	657,000	2.93	1,303,200	5.89	646,200	2.96	50

Present practice does not consist of financing highways of a single class with funds earned by that class. If costs and earnings were balanced for each class of highways, lightly traveled routes could seldom be improved with available funds to the minimum standard satisfactory to the highway users. The construction of lightly traveled secondary and local roads must be subsidized from excess earnings of heavily traveled routes. Unless this practice were followed, lightly traveled routes could not be developed unless additional funds from a new source were made available. Unless lightly traveled or feeder routes, which provide access to widely scattered points, were developed, the main highways would be less heavily traveled and the earning capacity of the main traveled routes would be reduced.

The interregional highway system tentatively selected is the most heavily traveled integrated national system that it has been possible to select. The routes in each State are invariably the greatest, or at least among the greatest, revenue producing routes. It would seem that even a lower percentage of their total earnings should be applied to the development and operation of the system than is applied to the remaining heavily traveled routes of the State highway systems, if equilibrium is to be maintained amongst the various systems.

It is interesting to note that even within the interregional system, table 19 shows that the total earnings during the 30-year period following improvement would exceed the total costs during the 30-year period by greater amounts for the more heavily traveled sections than for the more lightly traveled sections. The percentage of the earnings required for expenses over a 30-year period on sections having adjusted initial traffic densities of less than 3,000 vehicles is shown to be 63 percent. For sections falling within the intermediate traffic density group where 4-lane highway design is recommended, the percentage of the earnings required for expenses drops to 58; and for sections falling within the highest traffic density group, the percentage drops to 50.

These relationships are only preliminary indications. The main problem still lies ahead in refining the analysis by substituting facts and field determinations for present assumptions and estimates. The present analysis must be extended to include various methods of financing and complete studies must be made by regions and by States. Coincident with these studies, studies must be made of the amount that local roads must be subsidized from excess earnings of the more heavily traveled systems. In fact, analyses similar to this interregional system analysis must be applied to all systems. Standards for all systems must be adjusted to levels that can be afforded. These refinements and extensions of the analysis of the rural sections will require a great deal of work, but the larger and more significant job ahead is planning the improvement of urban sections.

The best preliminary estimate shows that the cost of urban sections of the tentative interregional system is only about one-fifth of the expenditure that must be made to modernize highway and street facilities in the cities traversed. The modernization of only the interregional system in the vincinity of cities would be but a palliative because the system would soon be overloaded by traffic attracted to its superior facilities. Only by construction of comparable facilities in other directions on the cities' street networks can the economic growth of cities and the success of the interregional system itself be assured.

APPENDIX

In the discussion of design standards it was stated that:

> The limiting degree of horizontal curvature must usually be selected on the basis of a number of economic considerations, only one of which is the extent to which desirable sight distances can be provided. Once the specifications for horizontal alinement and cross sections are settled, the sight distances limited by cut banks on horizontal curves are fixed. Obviously, no advantage to the traveling public can be gained by increasing lengths of vertical curves occurring on horizontal curves beyond those lengths required to provide sight distance equal to that afforded by the horizontal curve. There is, therefore, no justification for construction expenditures for this purpose.

On horizontal curves having sufficient length for the view between vehicles on the curve to be restricted by the cut bank, there is a constant, for any distance between the centerline of the highway and the cut bank, which, when divided by the degree of curvature may be multiplied by the algebraic difference in grades to give the length of vertical curve whose crest will limit sight distance to the same extent as the cut bank will limit it. Such a constant is specified for the interregional system and its value for the interregional highway cross section is 700.

For sections of the highway located on tangent, and on short horizontal curves where sight distance is not restricted by cut banks but by crests in vertical alinement, constants shown in table A are specified. These constants, when multiplied by the algebraic difference in grades, give lengths of vertical curves which will provide sight distances as great as can be afforded and yet maintain equilibrium between this feature of design and the other features. It will be noted that shorter vertical curves, and correspondingly shorter sight distances, are specified for 4-lane divided highways than are specified for 2-lane highways. This is done because the chief advantage in increasing the sight distance on 4-lane divided highways is that safe stopping distances for higher speeds of travel are provided; but on 2-lane highways, the further advantage is gained that vehicles traveling in the same direction may pass one another at higher speeds without increasing the hazard of meeting an oncoming car before completing the passing maneuver. This hazard obviously does not exist on 4-lane divided highways.

For the various classifications of 4-lane highway sections, the speeds for which adequate sight distances on vertical curves are provided are related to the speeds at which horizontal curves of the maximum degree may be negotiated safely, because the economic limits of both the degree of horizontal curvature and the length of vertical curve for various classification of highways are determined by the type of topography and the traffic service. Also, in terrain where drivers are required to reduce their speeds in order to negotiate the horizontal curves, relatively short vertical curves should not be found as objectionable as they are in flatter terrain. Careful consideration of the rate that excavation quantities increase with lengths of vertical curves has led to the conclusion that the greatest speed for which sight distances on crests in vertical alinement can be made equal to safe stopping distances, without excessive expenditures, is the maximum speed that can be traveled around horizontal curves of one-half the maximum degree (twice the minimum radius) specified for the particular classification of the highway section. This criterion has been selected because (1) most of the horizontal curves occurring on any section have shorter radii than the radius of a curve of half the maximum specified degree, which means that drivers of vehicles will generally be accustomed to reducing speeds below this critical speed on most of the horizontal curves, and (2) an examination of resulting speeds indicates that they are reasonable in relation to other factors.

TABLE A.—*Values of K*[1] *for computing length of vertical curves on horizontal tangents and short horizontal curves*[2]

Classification of section	Present average daily traffic density	Type of topography	Values of K	
			Minimum permissible	Maximum desirable
I	Less than 1,000	Relatively level	1,070	1,070
		Rolling	550	550
		Mountainous	260	260
II	1,000–1,999	Relatively level	1,070	1,070
		Rolling	550	550
		Mountainous	260	260
III	2,000–2,999	Relatively level	1,070	1,070
		Rolling	550	550
		Mountainous	260	260
IV	3,000–4,999	Relatively level	465	465
		Rolling	233	465
		Mountainous	175	465
V	5,000–9,999	Relatively level	465	465
		Rolling	350	465
		Mountainous	280	465
VI	10,000 or more	Relatively level	465	465
		Rolling	350	465
		Mountainous	280	465

[1] Length of vertical curve = algebraic difference of grades × K. For use only where sight distance is restricted by vertical curve.

[2] For computing lengths of vertical curves occurring on long horizontal curves where sight distance is restricted by cut bank, use formula $K = \frac{700}{D}$ in all traffic classifications and on all horizontal curves whose lengths are in excess of the following values:

	Feet		*Feet*
1° curve	1,060	6° curve	440
2° curve	750	7° curve	410
3° curve	620	8° curve	380
4° curve	530	9° curve	360
5° curve	480	10° curve	350

Maximum lengths of vertical curves in relatively level topography shall be 4,000 feet, in rolling topography 3,000 feet, and in mountainous topography 2,000 feet.

Values of the constants for computing lengths of vertical curves occurring at crests on 2-lane highways are based on providing sight distances permitting passing maneuvers (1) in relatively level topography when the passing and oncoming vehicles travel 60 miles per hour and the passed vehicle travels 50 miles per hour, (2) in rolling topography when the passing and oncoming vehicles travel 50 miles per hour and the passed vehicle travels 40 miles per hour, and (3) in mountainous topography when the passing and oncoming vehicles travel 40 miles per hour and the passed vehicle travels 30 miles per hour. Actually, passings can probably take place safely at higher speeds than these because the calculations are based on existing passing maneuver theory which appears to be on the conservative side. In cases where maximum algebraic differences in grades are approached, the standards specify reduced lengths of vertical curves below the values obtained by the use of the constants. These reduced lengths are necessary because of topographical difficulties and should be accepted even though the speeds at which passing maneuvers may take place are lowered by about 10 percent.

The maximum safe speeds of travel at any point where the sight distance is limited by any feature of the design are shown in table B.

TABLE B.—*Maximum safe speeds permitted by limiting vertical curves*[1] *suggested for interregional highways*

Classification of section	Present average daily traffic density	Type of topography	Speeds permitted on vertical curves occurring on long horizontal curves when sight distance is restricted by cut bank				Speeds permitted on vertical curves occurring on horizontal tangents or short horizontal curves			
			Minimum permissible length of vertical curve		Minimum desirable length of vertical curve		Minimum permissible length of vertical curve		Minimum desirable length of vertical curve	
			Lowest maximum safe speed [2]	Lowest maximum passing speed [3]	Lowest maximum safe speed [2]	Lowest maximum passing speed [3]	Lowest maximum safe speed [2]	Lowest maximum passing speed [3]	Lowest maximum safe speed [3]	Lowest maximum passing speed [3]
			M. p. h.	*M. p. h.*	*M. p. h.*	*M. p. h.*	*M. p. h.*	*M. p. h.*	*M. p. h.*	*M. p. h.*
I	Less than 1,000	Relatively level	68	28	68	28	80+	[4] 53-60	80+	[4] 53-60
		Rolling	53	20	68	28	[4] 76-80+	[4] 44-50	80+	50
		Mountainous	47	17	68	28	[4] 61-70	[4] 35-40	80+	40
II	1,000-1,999	Relatively level	68	28	68	28	80+	[4] 53-60	80+	[4] 53-60
		Rolling	53	20	68	28	[4] 76-80+	[4] 44-50	80+	50
		Mountainous	47	17	68	28	[4] 61-70	[4] 35-40	80+	40
III	2,000-2,999	Relatively level	68	28	68	28	80+	[4] 53-60	80+	[4] 53-60
		Rolling	56	20	68	28	79-80+	[4] 44-50	80+	50
		Mountainous	52	18	68	28	[4] 64-70	[4] 35-40	80+	40
IV	3,000-4,999	Relatively level	68	68	68	68	80+	80+	80+	80+
		Rolling	56	56	68	68	70	70	80+	80+
		Mountainous	52	52	68	68	64	64	80+	80+
V	5,000-9,999	Relatively level	68	68	68	68	80+	80+	80+	80+
		Rolling	63	63	68	68	78	78	80+	80+
		Mountainous	59	59	68	68	73	73	80+	80+
VI	10,000 or more	Relatively level	68	68	68	68	80+	80+	80+	80+
		Rolling	63	63	68	68	78	78	80+	80+
		Mountainous	59	59	68	68	73	73	80+	80+

[1] When sight distance is restricted by cut banks on horizontal curves, vertical curves have been selected which provide the same sight distances as do the horizontal curves. Therefore, lengthening of vertical curves would not make higher safe speeds possible.

[2] Lowest maximum safe speed is the maximum speed which vehicles can travel and yet stop safely within the sight distance provided on the shortest vertical curve permitted for the indicated classification of highway.

[3] Lowest maximum passing speed is the maximum speed which passing and oncoming vehicles may travel and yet complete a passing maneuver when the passed vehicle is traveling 10 miles per hour slower on the shortest vertical curve permitted for the indicated classification of highway.

[4] The lower speed applies when the algebraic difference in grades is the maximum permitted; the higher speed applies when the algebraic difference in grades is less than two-thirds of the maximum allowable.

MOTOR-FUEL CONSUMPTION-1940

COMPILED FOR CALENDAR YEAR FROM REPORTS OF STATE AUTHORITIES 1/

TABLE G-2, 1940
ISSUED MAY 1941

STATE	TAX RATE PER GALLON ON DECEMBER 31	GROSS AMOUNT REPORTED 2/	AMOUNT EXEMPTED FROM PAYMENT OF TAX 3/	GROSS AMOUNT ASSESSED FOR TAXATION	AMOUNT SUBJECT TO REFUND OF ENTIRE TAX	NET AMOUNT TAXED				AMOUNT TAXED AT PREVAILING RATE DURING 1939	INCREASE DURING 1940		STATE
						TOTAL	AT PREVAILING RATE	AT OTHER RATES			AMOUNT	PERCENTAGE	
								RATE PER GALLON	AMOUNT				
	CENTS	1,000 GALLONS	1,000 GALLONS	1,000 GALLONS	1,000 GALLONS	1,000 GALLONS	1,000 GALLONS	CENTS	1,000 GALLONS	1,000 GALLONS	1,000 GALLONS		
ALABAMA	6	259,915	-	259,915	-	259,915	259,915	-	-	241,375	18,540	7.7	ALABAMA
ARIZONA	5	113,435	4,575	108,860	13,153	95,707	95,707	-	-	89,939	5,768	6.4	ARIZONA
ARKANSAS	6.5	191,421	7,620	183,801	-	183,801	162,328	(4/)	21,473	155,709	6,619	4.3	ARKANSAS
CALIFORNIA	3	1,948,880	37,198	1,911,682	153,356	1,758,326	1,758,326	-	-	1,673,780	84,546	5.1	CALIFORNIA
COLORADO	4	251,877	8,645	243,232	36,490	206,742	206,742	-	-	196,147	10,595	5.4	COLORADO
CONNECTICUT	3	380,375	7,567	372,808	8,214	364,594	364,594	-	-	335,146	29,448	8.8	CONNECTICUT
DELAWARE	4	63,920	1,498	62,422	4,025	58,397	58,397	-	-	54,410	3,987	7.3	DELAWARE
FLORIDA	7	408,124	19,407	388,717	-	388,717	388,717	-	-	350,089	38,628	11.0	FLORIDA
GEORGIA	6	400,296	13,449	386,847	-	386,847	386,847	-	-	352,862	33,985	9.6	GEORGIA
IDAHO	5.1	107,644	3,677	103,967	-	103,967	94,565	(5/)	9,402	6/ 88,444	6,121	6.9	IDAHO
ILLINOIS	3	1,540,441	-	1,540,441	129,474	1,410,967	1,410,967	-	-	1,336,233	74,734	5.6	ILLINOIS
INDIANA	4	700,360	2,263	698,097	56,933	641,164	641,164	-	-	598,734	42,430	7.1	INDIANA
IOWA	3	572,720	-	572,720	86,725	485,995	485,995	-	-	469,102	16,893	3.6	IOWA
KANSAS	3	503,586	156,866	346,720	-	346,720	346,720	-	-	334,577	12,143	3.6	KANSAS
KENTUCKY	5	305,334	10,129	295,205	-	295,205	295,205	-	-	275,107	20,098	7.3	KENTUCKY
LOUISIANA	7	278,083	5,855	272,228	4	272,224	264,057	2	7/ 8,167	247,419	16,638	6.7	LOUISIANA
MAINE	4	157,361	957	156,404	-	156,404	149,130	1	8/ 7,274	141,850	7,280	5.1	MAINE
MARYLAND	4	314,606	4,854	309,752	20,107	289,645	286,636	3	9/ 3,009	265,548	21,088	7.9	MARYLAND
MASSACHUSETTS	3	747,204	2,941	744,263	30,905	713,358	713,358	-	-	683,733	29,625	10.4	MASSACHUSETTS
MICHIGAN	3	1,253,535	116,333	1,137,202	54,819	1,082,383	1,082,006	1.5	10/ 377	994,058	87,948	8.8	MICHIGAN
MINNESOTA	11/ 3	593,842	29,563	564,279	66,723	497,556	497,556	-	-	469,578	27,978	6.0	MINNESOTA
MISSISSIPPI	6	214,538	9,171	205,367	-	205,367	197,570	1	12/ 7,797	188,426	9,144	4.9	MISSISSIPPI
MISSOURI	2	697,545	-	697,545	39,224	658,321	658,321	-	-	620,791	37,530	6.0	MISSOURI
MONTANA	5	137,639	7,061	130,578	26,127	104,451	104,451	-	-	98,919	5,532	5.6	MONTANA
NEBRASKA	5	244,354	10,697	233,657	4	233,653	233,438	1	13/ 215	232,119	1,319	0.6	NEBRASKA
NEVADA	4	42,788	2,663	40,125	2,602	37,523	35,717	5	14/ 1,806	33,618	2,099	6.2	NEVADA
NEW HAMPSHIRE	4	95,827	653	95,174	4,352	90,822	90,822	-	-	88,448	2,374	2.7	NEW HAMPSHIRE
NEW JERSEY	3	898,684	2,978	895,706	73,280	822,426	822,426	-	-	773,346	49,080	6.3	NEW JERSEY
NEW MEXICO	5	110,917	5,569	105,348	11,152	94,196	94,196	-	-	86,374	7,822	9.1	NEW MEXICO
NEW YORK	4	1,970,555	76,621	1,893,934	56,957	1,836,977	1,836,977	-	-	1,768,288	68,689	3.9	NEW YORK
NORTH CAROLINA	6	463,498	9,786	453,712	-	453,712	440,548	1	12/ 13,164	410,340	30,208	7.4	NORTH CAROLINA
NORTH DAKOTA	4	147,246	61,466	85,780	-	85,780	85,780	-	-	15/ 82,694	3,086	3.7	NORTH DAKOTA
OHIO 16/	4	1,473,856	73,094	1,400,762	12,958	1,387,804	1,320,885	1	8/ 66,919	1,231,223	89,662	7.3	OHIO 16/
OKLAHOMA	4	441,161	62,316	378,845	570	378,275	378,275	-	-	365,735	12,540	3.4	OKLAHOMA
OREGON	5	264,672	5,017	259,655	29,816	229,839	228,396	1	17/ 1,443	212,609	15,787	7.4	OREGON
PENNSYLVANIA	4	1,581,975	6,897	1,575,078	-	1,575,078	1,575,078	-	-	1,476,077	99,001	6.7	PENNSYLVANIA
RHODE ISLAND	3	133,963	1,271	132,692	1,134	131,558	131,558	-	-	126,695	4,863	3.8	RHODE ISLAND
SOUTH CAROLINA	6	234,307	-	234,307	4,909	229,398	229,398	-	-	206,953	22,445	10.8	SOUTH CAROLINA
SOUTH DAKOTA	4	145,713	2,836	142,877	29,218	113,659	113,659	-	-	18/ 103,987	9,672	9.3	SOUTH DAKOTA
TENNESSEE	7	327,055	21,201	305,854	1,812	304,042	304,042	-	-	270,222	33,820	12.5	TENNESSEE
TEXAS	4	1,414,932	18,024	1,396,908	201,214	1,195,694	1,195,694	-	-	1,140,442	55,252	4.8	TEXAS
UTAH	4	107,194	4,769	102,425	-	102,425	102,425	-	-	94,349	8,076	8.6	UTAH
VERMONT	4	70,806	880	69,926	-	69,926	69,926	-	-	67;137	2,789	4.2	VERMONT
VIRGINIA	5	417,599	-	417,599	24,669	392,930	392,386	3	19/ 544	358,541	33,845	9.4	VIRGINIA
WASHINGTON	5	386,348	10,776	375,572	27,700	347,872	347,872	-	-	320,941	26,931	8.4	WASHINGTON
WEST VIRGINIA	5	221,005	-	221,005	6,022	214,983	214,983	-	-	18/ 201,640	13,343	6.6	WEST VIRGINIA
WISCONSIN	4	589,789	17,670	572,119	42,386	529,733	529,733	-	-	507,776	21,957	4.3	WISCONSIN
WYOMING	4	70,753	1,754	68,999	-	68,999	68,999	-	-	65,673	3,326	5.1	WYOMING
DISTRICT OF COLUMBIA	2	169,512	7,441	162,071	1,117	160,954	160,954	-	-	142,776	18,178	12.7	DISTRICT OF COLUMBIA
TOTAL	20/ 3.96	24,167,190	854,008	23,313,182	1,258,151	22,055,031	21,913,441	-	141,590	20,629,979	1,283,462	6.2	TOTAL

1/ AN ANALYSIS OF MOTOR-FUEL USAGE WILL BE GIVEN IN TABLE G-21, TO BE PUBLISHED LATER.

2/ EXPORT SALES AND OTHER AMOUNTS NOT REPRESENTING CONSUMPTION IN STATE HAVE BEEN ELIMINATED AS FAR AS POSSIBLE. IN CASES WHERE STATES FAILED TO REPORT AMOUNTS EXEMPTED FROM TAXATION, THE GROSS AMOUNT TAXED IS SHOWN IN THIS COLUMN.

3/ INCLUDES ALLOWANCES FOR EVAPORATION AND OTHER LOSSES, FEDERAL USE, OTHER PUBLIC USE, AND NONHIGHWAY USE, WHERE INITIAL EXEMPTIONS RATHER THAN REFUNDS ARE MADE.

4/ WITHIN 300 FEET OF BORDER, TAX IS REDUCED TO THAT OF ADJACENT STATE. GALLONS TAXED AT 2 CENTS, 5,366,000; AT 4 CENTS, 16,107,000.

5/ AVIATION FUEL TAXED AT 2.5 CENTS, 349,000 GALLONS; MOTOR FUEL TAXED AT 0.1 CENT (5 CENTS REFUNDED ON NONHIGHWAY USE), 9,053,000 GALLONS.

6/ GALLONS TAXED AT 5 CENTS, 3,003,000; AT 5.1 CENTS, 85,441,000.

7/ REPRESENTS EVAPORATION OR LOSS ALLOWANCE UNDER 5-CENT TAX NOT ALLOWED UNDER ADDITIONAL 2-CENT TAX, WHICH IS ADMINISTERED UNDER A SEPARATE LAW.

8/ THREE CENTS PER GALLON REFUNDED ON NONHIGHWAY USES.

9/ ONE CENT PER GALLON REFUNDED ON MOTOR FUEL USED IN VEHICLES LICENSED TO OPERATE EXCLUSIVELY IN CITIES.

10/ ONE AND ONE-HALF CENTS PER GALLON REFUNDED ON MOTOR FUEL USED IN INTERSTATE AVIATION.

11/ RATE CHANGED FROM 4 CENTS TO 3 CENTS SEPTEMBER 1.

12/ FIVE CENTS PER GALLON REFUNDED ON NONHIGHWAY USES.

13/ AVIATION FUEL USED IN FLYING INSTRUCTION.

14/ DIESEL FUEL, 1,749,000 GALLONS; AND BUTANE, 57,000 GALLONS.

15/ GALLONS TAXED AT 3 CENTS, 35,693,000; AT 4 CENTS, 47,001,000.

16/ AMOUNTS GIVEN DO NOT INCLUDE 65,204,000 GALLONS OF LIQUID FUEL (KEROSENE, FUEL OIL, ETC.) TAXED AT 1 CENT PER GALLON BUT NOT SUBJECT TO THE 3-CENT TAX ON MOTOR-VEHICLE FUEL.

17/ FOUR CENTS PER GALLON REFUNDED ON MOTOR FUEL USED IN AVIATION.

18/ REVISED SINCE PUBLICATION OF TABLE G-2, 1939.

19/ TWO CENTS PER GALLON REFUNDED ON MOTOR FUEL USED IN INTRASTATE AVIATION.

20/ WEIGHTED AVERAGE RATE.

STATE MOTOR-FUEL TAX RECEIPTS - 1940

COMPILED FOR CALENDAR YEAR FROM REPORTS OF STATE AUTHORITIES

TABLE G-1, 1940
ISSUED MAY 1941

STATE	TAX RATE PER GALLON ON DECEMBER 31	RECEIPTS FROM TAXATION OF MOTOR FUEL					OTHER RECEIPTS IN CONNECTION WITH MOTOR-FUEL TAX 2/					NET TOTAL RECEIPTS	LESS TAX ON AVIATION GASOLINE	ADJUSTED NET TOTAL RECEIPTS	STATE
		GROSS TAX COLLECTIONS	DEDUCTIONS BY DISTRIBUTORS FOR EXPENSES 1/	GROSS RECEIPTS BY STATE	REFUNDS PAID	NET RECEIPTS BY STATE	DISTRIBUTORS AND DEALERS LICENSES	INSPECTION FEES 3/	FINES AND PENALTIES	MISCELLANEOUS RECEIPTS	TOTAL				
	CENTS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	
ALABAMA	6	15,470	-	15,470	-	15,470	-	65	-	-	65	15,535	-	15,535	ALABAMA
ARIZONA	5	5,556	-	5,556	789	4,767	*	-	2	-	2	4,769	-	4,769	ARIZONA
ARKANSAS	6.5	11,312	-	11,312	-	11,312	-	100	*	-	100	11,412	-	11,412	ARKANSAS
CALIFORNIA	3	56,561	-	56,561	4,601	51,960	17	-	-	1	18	51,978	-	51,978	CALIFORNIA
COLORADO	4	9,632	-	9,632	1,341	8,291	-	-	-	-	-	8,291	-	8,291	COLORADO
CONNECTICUT	3	11,392	114	11,278	246	11,032	51	-	1	-	52	11,084	-	11,084	CONNECTICUT
DELAWARE	4	2,483	-	2,483	161	2,322	3	-	-	-	3	2,325	-	2,325	DELAWARE
FLORIDA	7	26,929	-	26,929	-	26,929	39	480	-	-	519	27,448	-	27,448	FLORIDA
GEORGIA	6	23,039	230	22,809	-	22,809	32	-	-	-	32	22,841	-	22,841	GEORGIA
IDAHO	5.1	5,281	-	5,281	459	4,822	1	-	-	2	3	4,825	8	4,817	IDAHO
ILLINOIS	3	46,191	924	45,267	3,907	41,360	-	463	1	-	464	41,824	-	41,824	ILLINOIS
INDIANA	4	27,787	-	27,787	2,293	25,494	*	573	-	1	574	26,068	-	26,068	INDIANA
IOWA	3	17,190	-	17,190	2,598	14,592	63	-	-	-	63	14,655	-	14,655	IOWA
KANSAS	3	10,402	-	10,402	-	10,402	15	110	-	35	160	10,562	-	10,562	KANSAS
KENTUCKY	5	14,861	148	14,713	-	14,713	-	-	4	-	4	14,717	-	14,717	KENTUCKY
LOUISIANA	7	18,584	-	18,584	-	18,584	-	87	*	-	87	18,671	-	18,671	LOUISIANA
MAINE	4	6,158	-	6,158	218	5,940	-	-	*	-	*	5,940	11	5,929	MAINE
MARYLAND	4	12,282	-	12,282	834	11,448	-	-	-	-	-	11,448	-	11,448	MARYLAND
MASSACHUSETTS	3	22,328	-	22,328	927	21,401	53	-	*	-	53	21,454	-	21,454	MASSACHUSETTS
MICHIGAN	3	34,116	-	34,116	1,650	32,466	5	-	8	-	13	32,479	81	32,398	MICHIGAN
MINNESOTA	4/ 3	20,933	-	20,933	2,588	18,345	1	174	1	5	181	18,526	-	18,526	MINNESOTA
MISSISSIPPI 5/	6	12,337	-	12,337	406	11,931	-	-	-	-	-	11,931	-	11,931	MISSISSIPPI 5/
MISSOURI	2	13,893	-	13,893	592	13,301	-	143	11	-	154	13,455	-	13,455	MISSOURI
MONTANA	5	6,378	-	6,378	1,310	5,068	-	6	-	-	6	5,074	-	5,074	MONTANA
NEBRASKA	5	12,133	91	12,042	300	11,742	10	120	-	29	159	11,901	73	11,828	NEBRASKA
NEVADA	4	1,620	31	1,589	104	1,485	*	21	1	-	22	1,507	-	1,507	NEVADA
NEW HAMPSHIRE	4	3,790	-	3,790	174	3,616	-	-	1	-	1	3,617	-	3,617	NEW HAMPSHIRE
NEW JERSEY	3	26,546	-	26,546	2,320	24,226	93	-	1	17	111	24,337	-	24,337	NEW JERSEY
NEW MEXICO	5	5,245	-	5,245	569	4,676	23	-	-	-	23	4,699	-	4,699	NEW MEXICO
NEW YORK	4	76,062	761	75,301	2,246	73,055	61	-	-	*	61	73,116	-	73,116	NEW YORK
NORTH CAROLINA	6	26,932	-	26,932	658	26,274	-	1,089	-	9	1,098	27,372	-	27,372	NORTH CAROLINA
NORTH DAKOTA	4	3,464	52	3,412	61	3,351	*	77	-	24	101	3,452	-	3,452	NORTH DAKOTA
OHIO	4	6/ 53,374	-	53,374	2,585	50,789	-	-	-	-	-	50,789	-	50,789	OHIO
OKLAHOMA	4	15,174	379	14,795	24	14,771	-	296	-	-	296	15,067	-	15,067	OKLAHOMA
OREGON	5	12,931	-	12,931	1,572	11,359	-	-	*	-	*	11,359	14	11,345	OREGON
PENNSYLVANIA	4	63,197	710	62,487	-	62,487	-	-	8	-	8	62,495	-	62,495	PENNSYLVANIA
RHODE ISLAND	3	4,277	-	4,277	336	3,941	4	-	-	-	4	3,945	-	3,945	RHODE ISLAND
SOUTH CAROLINA	6	13,899	-	13,899	277	13,622	-	288	-	-	288	13,910	73	13,837	SOUTH CAROLINA
SOUTH DAKOTA	4	5,827	205	5,622	1,169	4,453	-	74	-	-	74	4,527	16	4,511	SOUTH DAKOTA
TENNESSEE	7	21,245	-	21,245	133	21,112	-	1,146	-	62	1,208	22,320	142	22,178	TENNESSEE
TEXAS	4	55,903	557	55,346	7,828	47,518	-	-	-	12	12	47,530	-	47,530	TEXAS
UTAH	4	4,117	62	4,055	-	4,055	*	-	1	*	1	4,056	68	3,988	UTAH
VERMONT	4	2,781	-	2,781	-	2,781	-	-	*	-	*	2,781	-	2,781	VERMONT
VIRGINIA	5	20,645	-	20,645	1,241	19,404	1	-	4	1	6	19,410	16	19,394	VIRGINIA
WASHINGTON	5	18,732	94	18,638	1,466	17,172	3	-	-	10	13	17,185	-	17,185	WASHINGTON
WEST VIRGINIA	5	10,981	-	10,981	301	10,680	11	-	-	-	11	10,691	-	10,691	WEST VIRGINIA
WISCONSIN	4	22,861	-	22,861	1,711	21,150	-	161	-	-	161	21,311	-	21,311	WISCONSIN
WYOMING	4	2,772	-	2,772	-	2,772	2	-	-	-	2	2,774	54	2,720	WYOMING
DISTRICT OF COLUMBIA	2	3,244	-	3,244	22	3,222	7	-	-	-	7	3,229	-	3,229	DISTRICT OF COLUMBIA
TOTAL	7/ 3.96	918,847	4,358	914,489	50,017	864,472	495	5,473	44	208	6,220	870,692	556	870,136	TOTAL

1/ THE STATES FOR WHICH AMOUNTS ARE SHOWN MAKE ALLOWANCES TO DISTRIBUTORS FOR EXPENSE OF COLLECTING THE TAX. IN KENTUCKY, SOUTH DAKOTA, UTAH, AND WASHINGTON ALLOWANCES OF 2 1/4, 4, 3, AND 1 PERCENT, RESPECTIVELY, OF THE TAX OTHERWISE DUE ARE MADE IN CONSIDERATION OF BOTH EXPENSE OF COLLECTION AND GALLONAGE LOSSES IN HANDLING. IN THESE STATES THE ALLOWANCES FOR EXPENSES ONLY HAVE BEEN ESTIMATED AS 1, 3½, 1½, AND ½ PERCENT, RESPECTIVELY.

2/ STARS INDICATE AMOUNTS LESS THAN $500.

3/ FEES FOR INSPECTION OF MOTOR-VEHICLE FUEL. WHEREVER POSSIBLE, FEES FOR INSPECTION OF KEROSENE AND OTHER NON-MOTOR-VEHICLE FUELS HAVE BEEN ELIMINATED.

4/ RATE CHANGED FROM 4 CENTS TO 3 CENTS SEPTEMBER 1.

5/ SPECIAL COUNTY TAXES OF 3 CENTS PER GALLON IN HANCOCK COUNTY AND 2 CENTS PER GALLON IN HARRISON AND JACKSON COUNTIES, AMOUNTING TO $197,000 IN 1940, ARE IMPOSED FOR SEAWALL PROTECTION AND ARE NOT INCLUDED IN THIS TABLE.

6/ OHIO IMPOSES A 3-CENT TAX ON MOTOR-VEHICLE FUEL AND A 1-CENT TAX ON ALL LIQUID FUELS. THE RECEIPTS FROM THE 1-CENT TAX APPLICABLE TO NON-MOTOR-VEHICLE FUELS (KEROSENE, FUEL OIL, ETC.) WERE $638,000. THESE RECEIPTS HAVE BEEN ELIMINATED FROM THE TOTAL GIVEN, WHICH REPRESENTS A 4-CENT TAX ON MOTOR-VEHICLE FUEL.

7/ WEIGHTED AVERAGE RATE.

STATE MOTOR-VEHICLE REGISTRATIONS-1940

COMPILED FOR CALENDAR YEAR FROM REPORTS OF STATE AUTHORITIES 1/

TABLE MV-1, 1940
ISSUED MAY 1941

STATE	MOTOR VEHICLES									TRAILERS AND SEMITRAILERS				MOTORCYCLES				DEALERS REGISTRATIONS 7/		1939 TOTAL REGISTERED MOTOR VEHICLES	YEAR'S CHANGE IN MOTOR-VEHICLE REGISTRATIONS		STATE
	TOTAL	PRIVATE AND COMMERCIAL 2/					PUBLICLY OWNED			TOTAL	PRIVATE AND COMMERCIAL 6/	PUBLICLY OWNED		TOTAL	PRIVATE AND COMMERCIAL 2/	PUBLICLY OWNED		REGULAR	EXTRA PLATES		INCREASE OR DECREASE	PERCENTAGE CHANGE	
		TOTAL	PASSENGER VEHICLES 3/			TRUCKS AND TRACTOR TRUCKS	TOTAL	FEDERAL 4/	STATE, COUNTY, AND MUNICIPAL 5/			FEDERAL 4/	STATE, COUNTY, AND MUNICIPAL 5/			FEDERAL 4/	STATE, COUNTY, AND MUNICIPAL 5/						
			TOTAL	AUTOMOBILES (INCLUDING TAXICABS)	BUSSES																		
ALABAMA	347,123	339,853	277,006	273,114	3,892	62,847	7,270	2,514	4,756	5,323	5,263	60	-	1,069	1,012	57		3,292	-	331,742	15,381	4.6	ALABAMA
ARIZONA	143,451	138,403	113,295	112,945	350	25,108	5,048	2,806	2,242	5,323	5,000	102	221	586	513	37	36	320	1,484	136,037	7,414	5.4	ARIZONA
ARKANSAS	261,997	257,177	191,019	190,589	430	66,158	4,820	2,370	2,450	11,621	11,519	46	56	642	625	11	6	690	2,004	245,707	16,290	6.6	ARKANSAS
CALIFORNIA	2,810,566	2,773,659	2,453,958	2,453,958	(8/)	319,701	36,907	9,959	26,948	170,286	167,929	475	1,882	17,177	15,901	133	1,143	4,714		2,642,006	168,560	6.4	CALIFORNIA
COLORADO	355,309	352,110	293,792	292,626	1,166	58,318	3,199	3,199	-	1,740	1,703	37	-	1,392	1,379	13	-	4,250	-	345,884	9,425	2.7	COLORADO
CONNECTICUT	498,463	493,667	417,828	416,656	1,172	75,839	4,796	829	3,967	6,918	6,693	18	207	2,370	2,061	18	291	3,001	9,039	465,346	33,117	7.1	CONNECTICUT
DELAWARE	72,973	71,763	60,209	60,209	(8/)	11,554	1,210	427	783	3,417	3,375	9	33	359	300	5	54	882		69,109	3,864	5.6	DELAWARE
FLORIDA	503,678	495,210	415,420	413,723	1,697	79,790	8,468	2,380	6,088	20,803	20,360	46	397	1,966	1,736	49	181	2,137		458,615	45,063	9.8	FLORIDA
GEORGIA	513,097	502,603	415,421	412,439	2,982	87,182	10,494	4,992	5,502	15,288	14,926	279	83	2,242	1,668	440	134	444	2,555	477,713	35,384	7.4	GEORGIA
IDAHO	167,066	163,340	129,582	129,454	128	33,758	3,726	1,936	1,790	22,312	22,134	50	128	665	649	3	13	414	-	156,820	10,246	6.5	IDAHO
ILLINOIS	1,941,206	1,925,814	1,706,639	1,706,639	(8/)	219,175	15,392	4,805	10,587	29,504	28,962	155	387	7,841	7,116	99	626	4,679	-	1,863,486	77,720	4.2	ILLINOIS
INDIANA	1,003,240	994,006	857,849	856,528	1,321	136,157	9,234	2,061	7,173	75,077	75,005	72	-	5,583	5,338	30	215	2,669	-	969,593	33,647	3.5	INDIANA
IOWA	802,885	793,969	691,257	691,257	(8/)	102,712	8,916	1,915	7,001	96,732	96,102	102	528	2,977	2,874	35	68	1,989	4,766	774,227	28,658	3.7	IOWA
KANSAS	584,380	582,668	480,235	480,002	233	102,433	1,712	1,712	-	5,632	5,589	43	-	1,320	1,262	58	-	2,191	-	575,980	8,400	1.5	KANSAS
KENTUCKY	470,825	463,727	387,836	387,068	768	75,891	7,098	2,393	4,705	158	(9/)	158	-	1,629	1,258	371	-	883	-	444,218	26,607	6.0	KENTUCKY
LOUISIANA	372,830	365,429	283,636	280,663	2,973	81,793	7,401	2,421	4,980	14,367	13,939	93	335	1,432	1,342	24	66	342	-	346,820	26,010	7.5	LOUISIANA
MAINE	208,595	205,896	161,982	161,792	190	10/ 43,914	2,699	693	2,006	11,202	10/ 10,990	23	189	849	807	11	31	556	3,569	203,793	4,802	2.4	MAINE
MARYLAND	450,169	444,532	385,110	383,974	1,136	59,422	5,637	3,434	2,203	5,676	5,448	156	72	1,901	1,813	54	34	10,281	-	430,095	20,074	4.7	MARYLAND
MASSACHUSETTS	907,862	11/ 903,843	795,201	790,312	4,889	108,642	4,019	4,019	(11/)	16,281	16,092	189	-	1,065	970	95	(11/)	2,907	20,360	874,932	32,930	3.8	MASSACHUSETTS
MICHIGAN	1,556,571	1,552,561	1,401,686	12/ 1,400,838	848	12/ 150,875	4,010	4,010	-	161,008	160,762	246	-	4,920	4,773	147	-	2,043	2,043	1,475,616	80,955	5.5	MICHIGAN
MINNESOTA	879,862	871,351	746,888	746,289	599	124,463	8,511	3,126	5,385	90,522	90,168	135	219	2,641	2,437	58	146	3,570	-	848,572	31,290	3.7	MINNESOTA
MISSISSIPPI	264,439	259,013	198,086	196,478	1,608	60,927	5,426	1,985	3,441	5,384	5,323	61	-	403	380	7	16	2,747	-	248,789	15,650	6.3	MISSISSIPPI
MISSOURI	926,715	921,800	771,774	768,345	3,429	150,026	4,915	2,647	2,268	38,718	38,632	52	34	2,457	2,421	12	24	2,537	3,290	881,946	44,769	5.1	MISSOURI
MONTANA	196,116	191,032	143,068	143,068	(8/)	47,964	5,084	2,394	2,690	6,240	6,171	69	-	536	534	2	-	1,003	-	185,327	10,789	5.8	MONTANA
NEBRASKA	417,827	412,116	347,627	347,317	310	64,489	5,711	1,751	3,960	45,362	45,007	49	306	1,374	1,265	46	63	1,603	2,193	411,464	6,363	1.5	NEBRASKA
NEVADA	45,708	44,108	35,373	35,264	109	8,735	1,600	884	716	1,572	1,512	15	45	147	139	5	3	71	284	42,296	3,412	8.1	NEVADA
NEW HAMPSHIRE	136,109	135,384	105,322	105,034	288	30,062	725	725	-	6,130	6,096	34	-	704	700	4	-	587	-	131,963	4,146	3.1	NEW HAMPSHIRE
NEW JERSEY	1,101,213	1,086,966	949,840	944,630	5,210	137,126	14,247	3,490	10,757	8,371	8,218	153	-	5,535	4,973	48	514	3,046	18,620	1,041,337	59,876	5.7	NEW JERSEY
NEW MEXICO	128,159	125,056	95,795	94,534	1,261	29,261	3,103	1,839	1,264	2,929	2,853	76	-	439	409	4	26	156	92	123,549	4,610	3.7	NEW MEXICO
NEW YORK	2,778,312	2,743,014	2,407,253	2,399,496	7,757	335,761	35,298	7,315	27,983	52,622	51,251	331	1,040	12,229	10,846	223	1,160	5,388	-	2,689,288	89,024	3.3	NEW YORK
NORTH CAROLINA	610,121	591,946	504,489	503,494	995	87,457	18,175	4,725	13,450	44,670	44,386	284	-	1,967	1,862	105		9,739	-	587,832	22,289	3.8	NORTH CAROLINA
NORTH DAKOTA	184,016	182,287	145,903	145,746	157	36,384	1,729	924	805	1,185	1,162	23	-	271	269	2	-	589	436	178,161	5,855	3.3	NORTH DAKOTA
OHIO	1,942,639	1,918,929	1,728,275	1,728,275	(8/)	190,654	23,710	3,252	20,458	139,411	138,070	127	1,214	11,922	11,426	74	422	4,626	21,003	1,910,468	32,171	1.7	OHIO
OKLAHOMA	585,052	574,719	469,891	467,099	2,792	104,828	10,333	2,710	7,623	7,740	7,589	151	-	1,271	1,250	21	-	3,890	-	565,864	19,188	3.4	OKLAHOMA
OREGON	401,328	393,578	325,822	325,130	692	13/ 67,756	7,750	3,348	4,402	185	(13/)	185	-	1,847	1,833	14	-	695	818	376,736	24,592	6.5	OREGON
PENNSYLVANIA	2,169,702	2,145,849	1,883,094	1,877,495	5,599	262,755	23,853	4,406	19,447	33,559	32,840	170	549	12,180	11,268	76	836	34,321	-	2,082,862	86,840	4.2	PENNSYLVANIA
RHODE ISLAND	189,717	187,509	166,792	166,341	451	20,717	2,208	664	1,544	1,210	1,168	32	10	875	768	9	98	398	-	177,069	12,648	7.1	RHODE ISLAND
SOUTH CAROLINA	343,688	336,772	290,366	289,088	1,278	46,406	6,916	1,875	5,041	5,887	5,799	88	-	1,062	948	36	78	1,124	2,242	321,235	22,453	7.0	SOUTH CAROLINA
SOUTH DAKOTA	198,615	195,667	163,369	163,252	117	32,298	2,948	1,535	1,413	23,586	23,395	56	135	586	469	106	11	798	-	192,111	6,504	3.4	SOUTH DAKOTA
TENNESSEE	459,170	447,983	377,316	377,316	-	13/ 70,667	11,187	3,025	8,162	65	(13/)	65	-	1,651	1,641	10	-	580	-	433,982	25,188	5.8	TENNESSEE
TEXAS	1,719,313	1,694,113	1,343,673	1,342,861	812	350,440	25,200	7,313	17,887	56,913	55,666	456	791	5,505	4,774	346	385	3,396	-	1,641,662	77,651	4.7	TEXAS
UTAH	143,634	139,921	117,687	117,026	661	22,234	3,713	2,099	1,614	726	610	47	69	602	540	23	39	545	1,008	135,935	7,699	5.7	UTAH
VERMONT	94,472	93,645	84,017	14/ 83,922	95	14/ 9,628	827	827	-	2,362	2,315	47	-	450	433	17	-	634	-	91,407	3,065	3.4	VERMONT
VIRGINIA	509,191	498,838	422,591	422,591	-	76,247	10,353	4,362	5,991	13,003	12,630	222	151	2,505	2,246	122	137	6,286	-	469,518	39,673	8.4	VIRGINIA
WASHINGTON	576,248	562,495	474,261	473,048	1,213	88,234	13,753	5,991	7,762	24,535	23,859	304	372	2,732	2,407	210	115	1,644	3,405	546,435	29,813	5.5	WASHINGTON
WEST VIRGINIA	309,361	302,558	251,038	250,294	744	51,520	6,803	1,271	5,532	3,902	3,715	27	160	1,424	1,351	2	71	12,767	-	292,484	16,877	5.8	WEST VIRGINIA
WISCONSIN	913,055	900,915	751,664	750,953	711	149,251	12,140	2,983	9,157	7,383	7,019	113	251	3,826	3,531	19	276	-		859,173	53,882	6.3	WISCONSIN
WYOMING	88,166	85,657	66,758	66,613	145	18,899	2,509	1,567	942	10,524	10,313	125	86	380	297	83	-	385	-	84,990	3,176	3.7	WYOMING
DIST. OF COL.	165,220	161,914	147,986	146,612	1,374	13,928	3,306	1,860	15/ 1,446	1,092	929	35	128	818	658	55	105	210	2,672	167,426	-2,206	-1.3	DIST. OF COL.
AT LARGE	3,407	-	-	-	-	-	3,407	3,407	-	91	-	91	-	18	-	18	-	-	-	2,250	1,157	51.4	AT LARGE
TOTAL	32,452,861	32,025,365	27,434,979	27,372,397	62,582	4,590,386	427,496	143,175	284,321	1,314,547	1,298,487	5,982	10,078	136,402	125,532	3,447	7,423	152,085	101,883	31,009,870	1,442,991	4.7	TOTAL

1/ REGISTRATION PERIODS ENDING NOT EARLIER THAN NOVEMBER 30 AND NOT LATER THAN JANUARY 31 ARE CONSIDERED CALENDAR-YEAR PERIODS. IN THOSE STATES WHERE THE REGISTRATION PERIOD IS DEFINITELY REMOVED FROM THE CALENDAR YEAR, REGISTRATION FIGURES WERE OBTAINED FOR THE CALENDAR-YEAR PERIOD.

2/ WHEREVER POSSIBLE PUBLICLY OWNED VEHICLES AND VEHICLES NOT FOR HIGHWAY USE HAVE BEEN ELIMINATED FROM THESE COLUMNS.

3/ A COMPLETE SEGREGATION OF BUSSES FROM OTHER VEHICLES IS NOT AVAILABLE. THE BUS FIGURES GIVEN REPRESENT COMMERCIAL BUSSES IN MOST CASES, ALTHOUGH IN SOME STATES CONTRACT SCHOOL BUSSES ARE INCLUDED. WHERE NO BUSSES ARE TABULATED, THEY ARE INCLUDED WITH AUTOMOBILES, UNLESS OTHERWISE NOTED.

4/ DATA ON FEDERAL VEHICLES OBTAINED THROUGH AGENCY OF PROCUREMENT DIVISION, DEPARTMENT OF THE TREASURY.

5/ STATE, COUNTY, AND MUNICIPAL VEHICLES ARE INCLUDED WITH PRIVATE AND COMMERCIAL REGISTRATIONS IN COLORADO, KANSAS, MICHIGAN, NEW HAMPSHIRE, AND VERMONT. A SMALL NUMBER OF FEDERAL VEHICLES ARE INCLUDED IN THE FIGURES FOR INDIANA, KENTUCKY, LOUISIANA, MONTANA, NEW YORK, PENNSYLVANIA, AND VIRGINIA.

6/ FIGURES FOR TRAILERS AND SEMITRAILERS ARE AS REPORTED. APPARENT INCONSISTENCIES ARE DUE TO THE FACT THAT SOME STATES REQUIRE THE REGISTRATION OF TOURIST TRAILERS, LIGHT WORK TRAILERS, AND SIMILAR VEHICLES, WHEREAS OTHER STATES REGISTER ONLY FREIGHT-CARRYING TRAILERS AND SEMITRAILERS. WHEREVER POSSIBLE PUBLICLY OWNED VEHICLES AND VEHICLES NOT FOR HIGHWAY USE HAVE BEEN ELIMINATED FROM THIS COLUMN.

7/ FIGURES INCLUDE NEW-CAR, USED-CAR, AND MOTORCYCLE DEALERS REGISTRATIONS AND SOME WRECKER AND REPAIRER REGISTRATIONS. DATA ON DEALERS EXTRA PLATES ARE INCOMPLETE, ALTHOUGH THEY ARE INCLUDED WITH DEALERS REGISTRATIONS IN SOME STATES.

8/ INCLUDED WITH TRUCKS.

9/ TRAILERS OF 1,000 POUNDS CAPACITY OR MORE PROHIBITED ON HIGHWAYS, ALTHOUGH PERMITTED IN CITIES UNDER CITY LICENSES. TRACTOR-SEMITRAILERS REGISTERED AS TRUCKS. LIGHT TRAILERS PERMITTED BUT NOT REGISTERED.

10/ COMMERCIAL FULL TRAILERS INCLUDED WITH TRUCKS.

11/ APPROXIMATELY 7,500 PUBLICLY OWNED MOTOR VEHICLES AND 200 PUBLICLY OWNED MOTORCYCLES ARE INCLUDED WITH PRIVATE AND COMMERCIAL REGISTRATIONS.

12/ TAXICABS INCLUDED WITH TRUCKS.

13/ TRAILERS INCLUDED WITH TRUCKS.

14/ TRUCKS UNDER 1,500 POUNDS CAPACITY INCLUDED WITH PASSENGER CARS.

15/ INCLUDES 456 AUTOMOBILES OF THE DIPLOMATIC CORPS.

STATE MOTOR-VEHICLE RECEIPTS - 1940

COMPILED FOR CALENDAR YEAR FROM REPORTS OF STATE AUTHORITIES 1/

TABLE MV-2, 1940
ISSUED MAY 1941

STATE	TOTAL RECEIPTS	REGISTRATION FEES 2/								MISCELLANEOUS RECEIPTS									STATE
		MOTOR VEHICLES					OTHER VEHICLES		TOTAL	DEALERS LICENSES	OPERATORS AND CHAUFFEURS PERMITS	CERTIFICATE OF TITLE FEES	SPECIAL TITLING TAXES 4/	FINES AND PENALTIES	TRANSFER OR REREGISTRATION FEES	ESTIMATED SERVICE CHARGES, LOCAL COLLECTORS 5/	OTHER RECEIPTS LESS UNCLASSIFIED REFUNDS	TOTAL	
		PASSENGER VEHICLES 3/			TRUCKS AND TRACTOR-TRUCKS	TOTAL	TRAILERS	MOTORCYCLES											
		AUTOMOBILES (INCLUDING TAXICABS)	BUSSES	TOTAL															
	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	1,000 DOLLARS	
ALABAMA	4,548	-	-	-	-	4,244	-	-	4,244	3	125	-	-	170	-	-	6	304	ALABAMA
ARIZONA	1,225	383	27	410	460	870	92	2	964	6	25	80	-	9	14	-	127	261	ARIZONA
ARKANSAS	3,399	1,834	80	1,914	1,015	2,929	176	2	3,107	73	206	-		2	9	-	2	292	ARKANSAS
CALIFORNIA 6/	27,914	19,751	(7/)	19,751	4,747	24,498	1,188	79	25,765	81	140	-	-	197	1,522	-	209	2,149	CALIFORNIA 6/
COLORADO	2,797	8/ 1,689	-	1,689	8/ 481	2,170	39	2	2,211	32	176	176	-	53	87	-	62	586	COLORADO
CONNECTICUT	7,385	3,031	132	3,163	1,599	4,762	23	6	4,791	114	1,874	-		163	161	-	282	2,594	CONNECTICUT
DELAWARE	1,252	583	(7/)	583	316	899	44	1	944	8	107	62	-	93	29	-	9	308	DELAWARE
FLORIDA	8,002	4,507	211	4,718	2,059	6,777	359	9	7,145	25	419	260	-	-	1	129	23	857	FLORIDA
GEORGIA	2,768	1,059	134	1,193	554	1,747	246	2	1,995	14	723	-	-	-	10	-	26	773	GEORGIA
IDAHO	1,401	648	9	657	535	1,192	74	2	1,268	24	45	49	-	-	-		15	133	IDAHO
ILLINOIS	24,760	15,631	(7/)	15,631	6,771	22,402	235	19	22,656	102	567	646	-	39	535	-	215	2,104	ILLINOIS
INDIANA	10,596	6,490	92	6,582	1,791	8,373	381	10	8,764	52	770	386	-	36	382	271	-65	1,832	INDIANA
IOWA	12,987	9,208	(7/)	9,208	3,146	12,354	212	11	12,577	75	189	-	-	-	226	-	-80	410	IOWA
KANSAS	4,012	2,676	(7/)	2,676	879	3,555	69	5	3,629	32	48	87	-	196	16	-	4	383	KANSAS
KENTUCKY	5,509	1,829	107	1,936	1,292	3,228	(9/)	3	3,231	25	564	-	1,428	7	223	-	31	2,278	KENTUCKY
LOUISIANA	5,392	3,235	107	3,342	1,293	4,635	701	6	5,342	11	105	-	-	-	-	-	-66	50	LOUISIANA
MAINE	4,162	2,249	13	2,262	10/ 889	3,151	11/ 29	4	3,184	78	533	175	-	24	102	-	66	978	MAINE
MARYLAND	6,698	3,196	188	3,384	666	4,050	160	4	4,214	53	326	237	1,335	392	147	-	-6	2,484	MARYLAND
MASSACHUSETTS	7,319	2,851	150	3,001	1,487	4,488	21	2	4,511	70	2,728	-	-	2	-	-	8	2,808	MASSACHUSETTS
MICHIGAN	24,115	12/ 14,213	(7/)	14,213	5,788	20,001	1,290	18	21,309	99	1,168	920	-	-	356	-	263	2,806	MICHIGAN
MINNESOTA	10,305	7,230	105	7,335	2,081	9,416	373	8	9,797	59	160	-	-	140	-	-	149	508	MINNESOTA
MISSISSIPPI	3,009	-	-	-	-	2,951	-	-	2,951	3	-	-	-	48	-	-	7	58	MISSISSIPPI
MISSOURI	10,750	7,645	(7/)	7,645	1,514	9,159	177	13	9,349	95	390	505	-	3	383	-	25	1,401	MISSOURI
MONTANA 13/	1,721	937	(7/)	937	370	1,307	27	1	1,335	19	185	64	-	63	49	-	6	386	MONTANA 13/
NEBRASKA	2,839	1,301	25	1,326	985	2,311	62	2	2,375	36	138	177	-	-	77	-	36	464	NEBRASKA
NEVADA	313	176	1	177	108	285	7	1	293	2	-	-	-	2	15	-	1	20	NEVADA
NEW HAMPSHIRE	3,052	-	-	-	-	2,529	-	4	2,533	24	376	-	-	67	-	-	52	519	NEW HAMPSHIRE
NEW JERSEY	22,562	10,813	304	11,117	4,297	15,414	384	10	15,808	78	4,026	695	-	232	303	-	1,420	6,754	NEW JERSEY
NEW MEXICO	1,994	989	63	1,052	591	1,643	56	1	1,700	10	179	30	-	1	-	-	74	294	NEW MEXICO
NEW YORK	55,944	33,977	-	33,977	12,339	46,316	736	47	47,099	209	6,464	-	-	566	1,227	-	379	8,845	NEW YORK
NORTH CAROLINA	8,174	4,674	75	4,749	2,567	7,316	450	7	7,773	36	141	187	-	59	-	-	-22	401	NORTH CAROLINA
NORTH DAKOTA	1,661	1,165	14	1,179	345	1,524	5	1	1,530	21	22	63	22	-	-	-	3	131	NORTH DAKOTA
OHIO	30,376	15,831	(7/)	15,831	8,507	24,338	1,451	44	25,833	272	813	610	-	115	819	1,874	40	4,543	OHIO
OKLAHOMA	6,435	2,584	235	2,819	1,514	4,333	648	6	4,987	52	496	288	-	-	-	378	234	1,448	OKLAHOMA
OREGON	3,346	1,626	43	1,669	14/ 1,283	2,952	(7/)	5	2,957	26	81	215	-	30	-	-	37	389	OREGON
PENNSYLVANIA	38,891	20,544	601	21,145	9,150	30,295	578	33	30,906	409	3,301	2,301	-	12	1,671	-	291	7,985	PENNSYLVANIA
RHODE ISLAND	3,218	1,920	46	1,966	543	2,509	8	3	2,520	18	463	-	-	-	95	-	122	698	RHODE ISLAND
SOUTH CAROLINA	2,104	881	39	920	693	1,613	182	1	1,796	27	214	-	-	33	29	-	5	308	SOUTH CAROLINA
SOUTH DAKOTA	1,794	1,434	4	1,438	253	1,691	41	1	1,733	20	-	32	-	-	-	-	9	61	SOUTH DAKOTA
TENNESSEE	5,330	-	-	-	-	4,969	-	-	4,969	(15/)	59	-	-	156	-	-	146	361	TENNESSEE
TEXAS	22,422	13,258	154	13,412	7,130	20,542	627	21	21,190	43	368	387	-	-	294	-	140	1,232	TEXAS
UTAH	1,227	560	(7/)	560	16/ 511	1,071	(7/)	1	1,072	20	29	79	-	1	26	-	-	155	UTAH
VERMONT	2,625	17/ 1,529	13	1,542	17/ 647	2,189	42	3	2,234	28	299	-	-	-	58	-	6	391	VERMONT
VIRGINIA	7,159	4,711	-	4,711	1,521	6,232	170	7	6,409	69	97	322	-	-	210	-	52	750	VIRGINIA
WASHINGTON	3,728	1,427	68	1,495	1,237	2,732	310	7	3,049	15	170	150	-	48	104	175	17	679	WASHINGTON
WEST VIRGINIA	6,529	3,883	27	3,910	1,108	5,018	71	6	5,095	49	319	170	820	-	69	-	7	1,434	WEST VIRGINIA
WISCONSIN	13,075	9,739	168	9,907	2,543	12,450	288	16	12,754	27	38	7	-	-	239	-	10	321	WISCONSIN
WYOMING	603	324	-	324	220	544	46	1	591	8	-	-	-	-	3	-	1	12	WYOMING
DISTRICT OF COLUMBIA	1,751	780	16	796	461	1,257	22	3	1,282	16	232	88	-	-	34	-	99	469	DISTRICT OF COLUMBIA
PARTIAL TOTALS 18/	-	245,001	3,251	248,252	98,286	-	12,100	440	-	-	-	-	-	-	-	-	-	-	PARTIAL TOTALS 18/
FULL TOTALS	439,178	-	-	-	-	361,231	-	-	373,771	2,668	29,898	9,448	3,605	2,959	9,525	2,827	4,477	65,407	FULL TOTALS

1/ RECEIPTS FOR REGISTRATION PERIODS ENDING NOT EARLIER THAN NOVEMBER 30 AND NOT LATER THAN JANUARY 31 ARE CONSIDERED CALENDAR-YEAR RECEIPTS. IN THOSE STATES WHERE THE REGISTRATION PERIOD IS DEFINITELY REMOVED FROM THE CALENDAR YEAR, REGISTRATION RECEIPTS WERE OBTAINED FOR THE CALENDAR-YEAR PERIOD.

2/ SEGREGATION OF REGISTRATION FEES BY TYPE OF VEHICLE NOT AVAILABLE FOR ALABAMA, MISSISSIPPI, NEW HAMPSHIRE, AND TENNESSEE. TOTAL MOTOR-VEHICLE REGISTRATION FEES IN THOSE STATES INCLUDE TRAILER AND MOTORCYCLE FEES, EXCEPT IN NEW HAMPSHIRE, FOR WHICH MOTORCYCLE FEES WERE REPORTED SEPARATELY. DEALERS LICENSE FEES IN TENNESSEE ARE ALSO INCLUDED WITH MOTOR-VEHICLE REGISTRATION FEES.

3/ THE BUS REGISTRATION FEES ARE INCOMPLETE (SEE TABLE MV-1, 1940, NOTE 3). WHERE NO FEES ARE TABULATED, THE FEES OF BUSSES ARE INCLUDED WITH THOSE OF AUTOMOBILES, UNLESS OTHERWISE NOTED.

4/ THE PROCEEDS OF SPECIAL EXCISE AND PRIVILEGE TAXES ON NEW CAR SALES HAVE BEEN SEGREGATED AND ENTERED IN THIS COLUMN. RECEIPTS FROM A 2-PERCENT TAX IN OKLAHOMA AND A 3-PERCENT TAX IN SOUTH DAKOTA, EACH IMPOSED AS PART OF A GENERAL SALES TAX, WERE $1,413,950, AND $497,718, RESPECTIVELY.

5/ IN MANY STATES COUNTY OR LOCAL OFFICERS ARE ALLOWED SERVICE CHARGES FOR ISSUING REGISTRATIONS, OPERATORS LICENSES, ETC. IN THE MAJORITY OF CASES THESE CHARGES ARE INCLUDED IN REGISTRATION AND OTHER FEES. THE AMOUNTS SHOWN IN THIS COLUMN ARE ESTIMATES OF SERVICE CHARGES COLLECTED AND RETAINED BY LOCAL OFFICIALS AND NOT REPORTED ELSEWHERE IN THE TABLE.

6/ REGISTRATION FEES INCLUDE PROCEEDS OF STATE "VEHICLE LICENSE FEES", $13,117,816, IMPOSED IN ADDITION TO THE REGULAR REGISTRATION FEES OF $12,646,756.

7/ INCLUDED WITH TRUCK FEES.

8/ FEES OF 28,018 LIGHT TRUCKS INCLUDED WITH THOSE OF PASSENGER VEHICLES.

9/ TRAILERS OF 1,000 POUNDS CAPACITY OR MORE PROHIBITED ON HIGHWAYS, ALTHOUGH PERMITTED IN CITIES UNDER CITY LICENSES. TRACTOR-SEMITRAILERS REGISTERED AS TRUCKS. LIGHT TRAILERS PERMITTED BUT NOT REGISTERED.

10/ INCLUDES FEES OF COMMERCIAL FULL TRAILERS.

11/ FEES OF LIGHT TRAILERS AND COMMERCIAL SEMITRAILERS ONLY. FEES OF COMMERCIAL FULL TRAILERS INCLUDED WITH THOSE OF TRUCKS.

12/ TAXICAB FEES INCLUDED WITH THOSE OF TRUCKS.

13/ REGISTRATION FEES ARE COLLECTED BY COUNTIES AND STATE DOES NOT MAINTAIN COMPLETE RECORD. FIGURES GIVEN ARE ESTIMATES SUPPLIED BY STATE.

14/ INCLUDES TRAILER FEES.

15/ INCLUDED WITH REGISTRATION FEES.

16/ INCLUDES FEES OF BUSSES AND TRAILERS.

17/ FEES OF TRUCKS UNDER 1,500 POUNDS CAPACITY INCLUDED WITH THOSE OF PASSENGER CARS.

18/ TOTALS OF COLUMNS FOR WHICH FULLY CLASSIFIED DATA WERE NOT AVAILABLE FOR ALL STATES.

STATUS OF FEDERAL-AID HIGHWAY PROJECTS

AS OF MAY 31, 1941

STATE	COMPLETED DURING CURRENT FISCAL YEAR			UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR PROGRAMMED PROJECTS
	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	
Alabama	$ 4,532,129	$ 2,119,682	105.9	$ 6,463,196	$ 3,214,205	237.0	$ 1,790,100	$ 887,150	57.4	$ 2,108,720
Arizona	1,658,892	1,117,267	62.2	1,704,502	1,168,485	79.0	238,615	158,349	1.7	1,636,480
Arkansas	5,130,207	2,347,985	130.2	1,366,943	681,786	54.3	676,098	337,595	37.8	1,387,624
California	7,182,005	3,603,909	133.6	8,670,313	4,675,226	125.2	2,103,539	1,096,376	41.7	3,394,309
Colorado	2,529,042	1,364,397	199.2	2,344,465	1,363,086	104.9	778,156	430,911	69.8	2,961,086
Connecticut	1,952,321	945,967	16.2	1,784,135	868,069	18.1	575,967	280,284	9.0	1,090,689
Delaware	1,927,921	963,182	30.5	361,405	180,552	4.5	639,356	276,669	22.6	1,184,811
Florida	3,652,499	1,813,691	85.2	887,632	474,716	49.9	656,518	328,008	13.7	3,548,700
Georgia	3,413,741	1,652,691	199.5	7,068,427	3,544,463	278.1	2,282,339	1,141,170	109.1	6,535,207
Idaho	2,047,494	1,155,675	151.2	1,434,790	884,183	64.7	827,892	395,842	42.9	1,729,709
Illinois	7,171,478	3,504,867	157.9	8,554,046	4,277,773	180.6	1,900,052	949,470	41.0	4,597,913
Indiana	5,761,799	2,814,994	127.2	8,054,056	3,828,537	128.8	993,166	417,933	16.2	2,209,436
Iowa	5,641,075	2,660,020	198.2	4,749,139	2,268,158	161.1	1,693,942	809,050	90.2	1,574,347
Kansas	5,131,145	2,480,080	470.5	5,485,031	2,784,583	280.9	3,920,992	1,942,461	216.3	4,124,962
Kentucky	3,068,125	1,492,936	91.1	3,731,523	1,876,442	112.8	4,947,660	2,297,595	121.0	2,028,201
Louisiana	11,856,522	2,970,570	39.4	2,375,813	1,187,148	55.2	1,566,035	773,850	38.9	3,737,326
Maine	1,385,161	676,459	31.0	1,539,547	791,913	19.8	966,842	483,005	20.6	559,363
Maryland	1,270,568	623,817	29.1	3,665,235	1,831,513	29.9	430,900	135,000	2.3	1,759,504
Massachusetts	1,835,469	914,828	22.9	2,758,736	1,400,529	19.7	2,059,810	1,025,825	15.0	3,019,341
Michigan	6,385,064	2,922,971	224.1	9,406,920	4,690,860	214.0	589,400	294,700	9.1	2,490,398
Minnesota	6,455,327	3,113,854	531.9	5,458,736	2,719,077	286.6	4,195,944	2,080,657	232.8	3,099,925
Mississippi	3,350,021	1,550,947	139.5	7,982,716	3,910,558	453.6	853,700	425,100	49.4	1,247,006
Missouri	3,619,467	1,783,975	179.9	10,383,487	4,929,023	255.8	5,900,076	2,271,030	163.0	3,622,252
Montana	4,631,688	2,621,088	328.8	2,921,800	1,652,125	133.4	1,007,547	572,891	57.2	4,045,692
Nebraska	4,900,669	2,298,927	578.4	4,431,382	2,235,729	472.1	3,085,103	1,541,489	294.5	2,797,588
Nevada	1,585,633	1,342,400	80.0	1,761,074	1,478,267	79.2	1,010,137	794,058	47.4	658,339
New Hampshire	1,639,811	806,655	42.1	426,398	211,890	8.4	545,446	271,374	5.3	1,039,387
New Jersey	2,564,349	1,266,942	13.3	6,533,502	3,266,671	50.7	27,110	13,555		1,741,492
New Mexico	2,933,097	1,803,575	215.6	1,109,838	679,182	51.4	504,907	326,473	46.3	1,930,106
New York	11,435,832	5,519,494	199.0	11,987,960	5,966,392	153.0	1,356,945	534,522	16.5	4,471,711
North Carolina	4,406,245	2,200,608	235.0	5,802,434	2,894,170	244.6	747,530	356,595	32.4	2,738,306
North Dakota	2,084,039	1,101,526	212.6	3,688,594	2,058,721	292.6	1,839,060	929,613	154.4	4,326,726
Ohio	7,228,202	3,600,519	93.4	14,856,305	7,406,088	123.9	5,293,648	2,401,685	37.8	3,632,335
Oklahoma	3,363,644	1,778,855	151.5	2,998,424	1,545,424	98.0	2,342,140	1,213,896	89.8	4,850,065
Oregon	3,480,704	2,078,861	160.4	3,830,842	2,063,246	111.8	1,199,063	671,410	10.6	881,852
Pennsylvania	8,126,306	3,999,124	100.5	14,057,274	6,923,640	118.3	1,948,908	963,900	19.9	3,546,750
Rhode Island	1,313,964	642,140	13.2	1,102,946	550,832	9.9	197,310	98,655	1.6	1,075,517
South Carolina	2,510,834	1,211,198	190.0	4,073,447	1,903,387	135.4	418,810	171,057	23.6	2,133,518
South Dakota	3,232,680	1,824,453	544.6	4,454,883	2,770,573	543.9	1,131,370	659,700	181.1	2,985,129
Tennessee	3,421,603	1,694,964	75.1	5,192,596	2,596,298	152.9	1,543,892	771,946	19.8	3,637,042
Texas	8,970,044	4,347,317	520.0	14,009,871	6,919,759	603.9	3,077,165	1,432,470	145.8	7,112,925
Utah	1,078,435	768,501	75.0	1,731,476	1,302,473	56.9	635,822	393,059	20.7	900,173
Vermont	1,308,660	624,484	37.6	1,092,828	552,552	31.8	387,654	189,176	6.1	404,325
Virginia	3,118,810	1,476,053	80.0	4,544,042	2,127,804	75.8	1,337,692	589,542	30.7	1,920,472
Washington	4,443,677	2,283,267	91.4	2,011,112	1,074,049	23.8	443,358	235,015	4.0	1,638,797
West Virginia	2,188,728	1,083,857	76.4	4,175,160	2,080,547	80.1	364,570	182,218	5.2	1,770,918
Wisconsin	5,707,254	2,801,205	201.7	3,322,886	1,652,288	123.1	683,992	318,740	20.3	4,627,835
Wyoming	1,820,709	1,111,594	196.3	1,843,380	1,199,056	180.7	275,927	154,376	20.2	1,235,788
District of Columbia	498,667	249,021	5.1	828,211	413,509	2.6	271,446	135,481	1.1	420,250
Hawaii	338,503	167,392	6.0	546,698	292,545	7.8	38,944	19,472	.3	1,973,814
Puerto Rico	709,534	351,220	15.4	1,583,127	781,640	20.3	267,936	131,600	2.1	805,679
TOTALS	195,999,793	95,650,004	7,894.8	231,149,283	118,149,742	7,200.8	72,570,531	35,311,998	2,716.3	128,949,840

STATUS OF FEDERAL-AID SECONDARY OR FEEDER ROAD PROJECTS

AS OF MAY 31, 1941

STATE	COMPLETED DURING CURRENT FISCAL YEAR			UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			BALANCE OF FUNDS AVAILABLE FOR PROGRAMMED PROJECTS
	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	Estimated Total Cost	Federal Aid	Miles	
Alabama	$ 190,944	$ 95,263	9.3	$ 1,333,057	$ 667,758	60.8	$ 41,700	$ 20,850	0.1	$ 607,504
Arizona	240,302	168,815	23.6	202,398	149,242	5.3	50,713	31,527	8.7	365,891
Arkansas	463,572	202,807	14.9	412,654	205,474	32.6				309,298
California	1,056,411	564,761	40.5	1,177,912	850,598	13.8	429,723	226,939	12.1	486,549
Colorado	276,356	154,551	9.8	175,652	98,569	26.7				345,179
Connecticut	370,531	179,413	4.6	298,035	136,331	6.1				187,829
Delaware	127,253	63,627	12.7	46,219	22,675	2.9	258,291	118,835	12.3	224,684
Florida	91,270	45,227	8.7	1,096,579	547,839	11.7				285,907
Georgia	296,304	147,033	26.9	940,929	520,815	67.8	346,525	173,262	34.2	1,161,565
Idaho	154,346	91,644	24.0	289,104	174,459	13.8	18,414	9,252	5.5	247,016
Illinois	1,766,825	829,343	80.6	1,193,850	581,925	52.0	818,290	388,050	34.2	426,478
Indiana	471,760	222,327	31.0	352,964	181,939	18.9	1,465,471	652,716	69.9	600,475
Iowa	2,441,922	1,160,111	544.0	648,074	302,785	179.2	143,140	56,062	31.2	468,200
Kansas	396,841	197,497	50.2	846,651	430,896	45.6	1,268,141	635,170	133.5	1,018,002
Kentucky	799,718	268,935	65.5	762,283	214,927	26.7	1,035,400	253,911	74.1	328,487
Louisiana	112,966	52,661	10.9	564,708	230,289	20.2	168,715	84,358	14.6	500,503
Maine	303,854	139,080	17.0	40,606	20,303	1.5				161,212
Maryland	128,300	64,150	5.5	451,390	222,695	17.3	117,500	47,000	4.2	330,351
Massachusetts	523,320	259,348	10.5	177,572	104,717	3.4	605,103	301,067	10.8	378,087
Michigan	1,582,408	738,209	128.6	805,460	402,730	37.2	513,900	256,950	40.1	604,654
Minnesota	793,611	382,232	122.5	1,133,595	571,047	139.0	423,498	179,368	51.7	940,987
Mississippi	278,087	137,780	12.5	925,194	463,947	51.9	209,800	93,365	9.3	651,872
Missouri	762,270	376,672	103.9	326,112	157,075	25.0	668,366	279,656	75.1	869,097
Montana	712,410	402,588	98.0	389,844	220,819	38.2	279,332	158,599	54.5	629,537
Nebraska	751,855	356,768	119.3	423,696	217,126	48.3	357,828	178,562	45.6	389,255
Nevada	206,236	167,549	40.9	186,061	161,978	19.6	97,767	84,959	4.5	143,066
New Hampshire	143,639	68,883	3.4	71,533	34,946	3.6	83,573	41,587	1.1	181,693
New Jersey	390,996	195,060	15.3	337,342	188,185	7.5	436,810	218,405	12.7	443,889
New Mexico	445,310	225,926	25.8	395,008	235,715	21.9	150,634	96,358	26.6	220,206
New York	2,357,156	1,117,810	77.9	1,239,034	621,991	30.5				818,145
North Carolina	1,001,149	497,279	89.4	604,099	304,628	51.8	102,240	51,120	15.3	443,937
North Dakota	80,071	42,652	.3	136,016	74,496	3.5				1,276,906
Ohio	1,710,388	848,861	59.8	2,064,770	1,079,580	64.9	450,180	223,915	5.3	953,308
Oklahoma	795,576	416,089	57.1	301,276	159,134	14.8	488,330	257,767	47.3	967,589
Oregon	407,563	227,326	61.3	370,544	167,124	27.2	176,886	100,050	16.4	337,018
Pennsylvania	1,728,851	846,811	59.9	1,632,189	815,164	34.4	792,210	385,969	13.3	122,113
Rhode Island	262,488	120,687	3.6	93,806	50,516	.9	121,212	60,435	1.7	63,989
South Carolina	647,847	238,916	90.4	668,457	256,366	51.0	377,700	140,124	11.5	159,848
South Dakota	3,714	3,624		25,302	15,768	9.0	9,240	5,190	6.2	1,537,944
Tennessee	150,805	71,863	8.7	287,466	143,733	10.0	1,355,580	677,790	48.2	558,227
Texas	1,517,781	742,578	202.0	1,188,396	587,563	111.5	325,220	149,900	39.3	1,465,584
Utah	181,542	110,320	23.9	236,725	156,443	13.8	32,539	16,780	9.4	211,407
Vermont	323,296	116,366	13.1	193,984	56,234	7.6				89,704
Virginia	522,235	244,363	28.1	414,868	192,991	16.4	319,464	136,740	3.9	380,410
Washington	631,616	320,705	31.0	504,263	287,828	28.0				262,848
West Virginia	334,392	165,602	18.5	285,050	142,525	7.9	438,997	218,945	18.3	310,650
Wisconsin	328,957	163,259	7.4	950,433	482,153	32.6	819,984	342,962	35.6	554,741
Wyoming	431,815	260,037	42.8	369,790	159,928	18.8	38,360	17,300	9.1	200,812
District of Columbia	112,164	56,082	1.4	58,203	29,096	.6	30,529	14,750	.3	73,194
Hawaii	264,732	132,578	8.6	1,096	1,096					250,559
Puerto Rico	193,690	94,735	8.7	231,364	112,855	10.6				134,597
TOTALS	30,267,445	14,796,803	2,554.3	27,861,813	14,215,016	1,544.3	15,867,305	7,386,545	1,047.7	24,681,003

PUBLICATIONS of the PUBLIC ROADS ADMINISTRATION

Any of the following publications may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C. As his office is not connected with the Agency and as the Agency does not sell publications, please send no remittance to the Federal Works Agency.

ANNUAL REPORTS

Report of the Chief of the Bureau of Public Roads, 1931. 10 cents.

Report of the Chief of the Bureau of Public Roads, 1933. 5 cents.

Report of the Chief of the Bureau of Public Roads, 1934. 10 cents.

Report of the Chief of the Bureau of Public Roads, 1935. 5 cents.

Report of the Chief of the Bureau of Public Roads, 1936. 10 cents.

Report of the Chief of the Bureau of Public Roads, 1937. 10 cents.

Report of the Chief of the Bureau of Public Roads, 1938. 10 cents.

Report of the Chief of the Bureau of Public Roads, 1939. 10 cents.

HOUSE DOCUMENT NO. 462

Part 1 . . . Nonuniformity of State Motor-Vehicle Traffic Laws. 15 cents.

Part 2 . . . Skilled Investigation at the Scene of the Accident Needed to Develop Causes. 10 cents.

Part 3 . . . Inadequacy of State Motor-Vehicle Accident Reporting. 10 cents.

Part 4 . . . Official Inspection of Vehicles. 10 cents.

Part 5 . . . Case Histories of Fatal Highway Accidents. 10 cents.

Part 6 . . . The Accident-Prone Driver. 10 cents.

MISCELLANEOUS PUBLICATIONS

No. 76MP . . The Results of Physical Tests of Road-Building Rock. 25 cents.

No. 191MP. . Roadside Improvement. 10 cents.

No. 272MP. . Construction of Private Driveways. 10 cents.

No. 279MP. . Bibliography on Highway Lighting. 5 cents.

Highway Accidents. 10 cents.

The Taxation of Motor Vehicles in 1932. 35 cents.

Guides to Traffic Safety. 10 cents.

An Economic and Statistical Analysis of Highway-Construction Expenditures. 15 cents.

Highway Bond Calculations. 10 cents.

Transition Curves for Highways. 60 cents.

Highways of History. 25 cents.

DEPARTMENT BULLETINS

No. 1279D . . Rural Highway Mileage, Income, and Expenditures, 1921 and 1922. 15 cents.

No. 1486D . . Highway Bridge Location. 15 cents.

TECHNICAL BULLETINS

No. 55T . . . Highway Bridge Surveys. 20 cents.

No. 265T. . . Electrical Equipment on Movable Bridges. 35 cents.

Single copies of the following publications may be obtained from the Public Roads Administration upon request. They cannot be purchased from the Superintendent of Documents.

MISCELLANEOUS PUBLICATIONS

No. 296MP. . Bibliography on Highway Safety.

House Document No. 272 . . . Toll Roads and Free Roads.

Indexes to PUBLIC ROADS, volumes 6–8 and 10–20, inclusive.

SEPARATE REPRINT FROM THE YEARBOOK

No. 1036Y . . Road Work on Farm Outlets Needs Skill and Right Equipment.

TRANSPORTATION SURVEY REPORTS

Report of a Survey of Transportation on the State Highway System of Ohio (1927).

Report of a Survey of Transportation on the State Highways of Vermont (1927).

Report of a Survey of Transportation on the State Highways of New Hampshire (1927).

Report of a Plan of Highway Improvement in the Regional Area of Cleveland, Ohio (1928).

Report of a Survey of Transportation on the State Highways of Pennsylvania (1928).

Report of a Survey of Traffic on the Federal-Aid Highway Systems of Eleven Western States (1930).

UNIFORM VEHICLE CODE

Act I.—Uniform Motor Vehicle Administration, Registration, Certificate of Title, and Antitheft Act.

Act II.—Uniform Motor Vehicle Operators' and Chauffeurs' License Act.

Act III.—Uniform Motor Vehicle Civil Liability Act.

Act IV.—Uniform Motor Vehicle Safety Responsibility Act.

Act V.—Uniform Act Regulating Traffic on Highways.

Model Traffic Ordinances.

A complete list of the publications of the Public Roads Administration, classified according to subject and including the more important articles in PUBLIC ROADS, may be obtained upon request addressed to Public Roads Administration, Willard Bldg., Washington, D. C.

STATUS OF FEDERAL-AID GRADE CROSSING PROJECTS

AS OF MAY 31, 1941

STATE	COMPLETED DURING CURRENT FISCAL YEAR					UNDER CONSTRUCTION					APPROVED FOR CONSTRUCTION					BALANCE OF FUNDS AVAILABLE FOR PROGRAMMED PROJECTS
			NUMBER					NUMBER					NUMBER			
	Estimated Total Cost	Federal Aid	Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise	Estimated Total Cost	Federal Aid	Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise	Estimated Total Cost	Federal Aid	Grade Crossings Eliminated by Separation or Relocation	Grade Crossing Structures Reconstructed	Grade Crossings Protected by Signals or Otherwise	
Alabama	$ 288,272	$ 288,189	4		7	$ 649,253	$ 629,200	5	1	2	$ 145,390	$ 145,390	2	2	6	$ 1,014,605
Arizona	202,308	194,942	3		2	339,710	339,362	2			29,350	29,350		1	2	207,575
Arkansas	1,200,084	1,194,779	11	1	15	454,968	454,639	5		1	150,877	150,822	1		3	344,619
California	474,671	472,281	4		19	1,031,503	850,904	7	1		684,027	684,027	2		7	1,458,206
Colorado	18,386	18,386			3	380,953	380,953	2			447,032	439,799	4		1	623,485
Connecticut	622,002	611,366	5	1		166,222	165,415	2			55,869	54,783		1		563,322
Delaware	108,682	108,682	4		17	94,135	94,135	1			176,448	175,348	1		1	384,873
Florida	228,495	223,997	2		5	366,897	365,383	4	1	2	188,859	188,859	1		25	1,183,217
Georgia	256,047	254,148	5	2	13	1,242,104	1,242,104	10	7	2	217,434	217,434	1	1	15	1,974,385
Idaho	302,149	291,486	5		35	14,943	14,943				95,098	95,098	1		3	481,562
Illinois	1,815,943	1,681,006	10		80	1,477,555	1,251,765	5	1	77	1,041,144	1,012,138	6		28	1,890,761
Indiana	785,008	776,856	4	2	87	946,240	906,953	7	1	10	101,550	95,841			26	956,891
Iowa	528,992	506,257	4		98	477,490	456,245	6	2	2	592,469	590,415	3		42	797,573
Kansas	846,646	839,306	11		18	544,768	544,768	9	2	3	95,752	95,752	3		5	1,278,276
Kentucky	579,583	551,568	8		12	1,036,397	1,035,397	9			218,085	218,085	3	1	1	358,480
Louisiana	436,153	422,870	3		1	202,163	202,163	4			553,700	553,694	6		2	916,044
Maine	159,988	159,070	1	1	6	132,646	132,646	1	1							393,580
Maryland	183,547	183,543	1		3	482,459	450,666	2	2	6	393,550	180,550	1		12	800,364
Massachusetts	16,588	16,588		1		426,750	416,112	2			505,452	504,322	3	1		1,820,605
Michigan	1,169,498	1,112,969	8	1	40	1,544,745	1,544,745	4	5		305,600	305,600			4	878,520
Minnesota	1,443,347	1,432,956	12	2	20	1,065,804	1,065,804	8	5		276,580	276,580	1	2	2	990,812
Mississippi	308,819	308,819	4	1	1	664,475	664,475	9			142,499	142,499	1	1	9	645.125
Missouri	1,207,124	1,206,565	6	4	1	1,921,553	1,466,133	5	4		181,880	159,161	1	1		1,253,824
Montana	434,356	434,356	5		4	90,520	90,520	1		1	96,536	96,536	1		2	512,684
Nebraska	438,949	436,440	3	1	14	894,621	894,621	15	1	2	389,818	389,818	8		24	183,237
Nevada	75,015	74,810	1		20	118,272	118,272	3			71,448	71,448	1		5	106,425
New Hampshire	104,313	104,277	3		1	148,837	148,017	3		1	131,062	82,451	1	1		344,297
New Jersey	278,937	278,937	2		4	1,192,373	1,066,823	6	1	1	59,140	59,140		1		1,049,600
New Mexico	348,049	339,475	4		6	73,664	73,664	1			159,441	159,441	1			498,993
New York	1,534,851	1,491,256	9	6	8	3,580,443	3,524,972	5	16		666,950	518,000		2		3,041,087
North Carolina	768,045	767,977	10	3	33	630,009	629,769	4	7	10	162,196	162,196		1	26	1,050,385
North Dakota	417,276	415,284	5		22	470,440	457,503	5		1	200,750	128,500	4			726,613
Ohio	1,372,166	1,300,972	7	2	17	2,404,847	2,373,804	13	1		1,706,340	1,656,340	6		3	1,294,259
Oklahoma	785,879	780,074	11	1	58	266,622	263,206	2		6	789,479	730,952	6		33	1,601,171
Oregon	208,640	159,119	3			411,078	347,465	4			18,280	18,280	1		4	392,976
Pennsylvania	1,387,269	1,377,793	13	2		2,671,627	2,667,799	20			1,578,372	1,459,925	5			2,513,593
Rhode Island	8,222	7,406				206,703	206,703		1							178,256
South Carolina	474,196	473,546	4	3	25	206,011	206,011	3	1	3	553,412	466,625	3	3	27	743,454
South Dakota	136,032	133,406	2	1	4	564,332	563,472	16			253,413	237,463	5		9	868,739
Tennessee	244,480	231,146	2	2		300,646	291,646	3	3		1,118,708	1,118,708	6	1		925,530
Texas	1,630,991	1,609,827	12	1	9	1,792,268	1,776,081	19		1	622,116	566,789	6			1,578,844
Utah	133,708	133,399			51	83,515	82,772	3		12	96,722	96,722			35	248,062
Vermont	143,924	143,684		1	12	115,533	115,533		1		16,478	16,478			4	293,090
Virginia	322,483	319,995	3	2	14	681,709	681,709	5	3		385,248	309,869	2	2	3	583,843
Washington	362,481	357,499	4	2	10	440,794	440,794	3	3	1	9,250	9,250			3	455,408
West Virginia	119,730	119,730	1		3	530,502	524,882	6			366,430	362,566	4	1	6	639,695
Wisconsin	825,078	809,586	6	4	7	553,004	523,781	4		8	621,505	620,731	2	2	43	1,159,122
Wyoming	91,384	91,379	1		2	481,657	481,656	6			2,258	2,258			4	291,888
District of Columbia	56,868	56,868	1			2,193	2,193				298,213	273,744		1		1,462
Hawaii	8,416	8,141			2	405,282	404,759	4								181,412
Puerto Rico	90,290	89,720	5			612,557	607,666	8			130,412	127,830	2			336,559
TOTALS	25,984,360	25,402,731	232	47	809	35,593,792	34,241,003	271	71	152	17,102,622	16,057,607	105	26	425	43,017,388

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